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NEW METHODS IN REMOVABLE BRIDGEWORK

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IN THE preliminary discourse of his "Dental Surgery," Dr. Fitch says, "If the value of any science is to be estimated by its comparative utility, dental surgery will hold a distinguished place in the esteem of mankind. When we consider the extensive influence which the state of the teeth exerts upon the functions of the stomach and the organs of digestion, this subject rises in importance, and assumes a character and consequence not usually ascribed to it."

That was a century ago; have we as yet eliminated the implication that the goal of this ideal still remains a thing of the future as it did to our predecessors in the early part of the last century?

Since it has become an established fact that micro-organisms not only infect the areas outside the apices of pulpless teeth but actually invade the tubules of live teeth where the dentin has become exposed, the advisability of having bridges for the replacement of lost teeth made removable is more apparent than ever before. Formerly, the hygiene of the mouth made removable bridges, for the sake of cleanliness, preferable to the fixed restorations; now the systemic susceptibility and future health of the patient demand protection against the minute cocci and bacilli that are able, with the slightest encouragement, to enter the tissues and menace the entire economy.

When a patient seeks the services of a prosthetic dentist for the restoration of missing teeth, the first thing the dentist should consider is how those teeth may be replaced with the least possible damage to the patient's remaining equipment. Someone was responsible for the

loss of the teeth that are to be replaced; it is the prosthetic dentist's duty to cause as little subsequent loss as possible in completing the restoration.

This he cannot do if he is only a prosthetic dentist, for the causes of the loss of the other teeth must be taken into consideration and recurrences prevented. He must be a bacteriologist, for most of these conditions are caused by bacteria; he must be a root-canal expert in order to know when the supporting teeth are worthy of his work; he must be a surgeon, or have complete knowledge of the surgery requisite for the removal of pathologic conditions with the least sacrifice of masticating surface; he must be a constructive artist in order to replace, as nearly as possible, the form and appearance of the structures that are lost; he must be an engineer of ability, able to utilize small attachments to sustain great stress, by controlling the direction of the forces of mastication; he must be a physiologist, who must meet, in more ways than one, the requirements of the initial processes of digestion; he must be an oral hygienist, contributing with his designs to the facility of cleansing the oral cavity; and he must be an accomplished expert in finance, if he wishes to continue the construction of removable bridges for his patients, ignorant as they are today of the value of their teeth.

Fig. 1.—Appearance of jaw in which a tooth is absent, with resultant loss of occlusal surface; tilting of molar; muscular pressure on condyle; lateral pressure on enamel and periodontal membranes, etc.

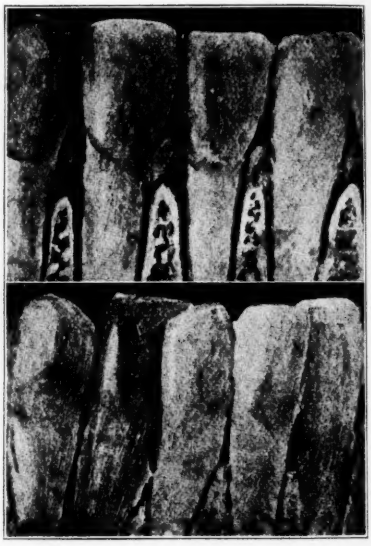

Fig. 2.—Above: Blood supply under normal conditions. Below: Impairment of blood supply due to crowding.

The mechanism of mastication is a much more complicated contrivance than is generally supposed, even by the majority of dentists, and the loss of a single tooth from it, or even the malposition of a single cusp in this intricate mechanism, is a catastrophe whose subsequent disastrous results are incalculable. We are forced by the existing conditions to take advantage of the

wonderful adaptability of Nature, but it must be remembered that the more Nature is compelled to exercise this phenomenon, the shorter will be the duration of her activity. (Figs. 1, 2 and 3.)

We have all encountered people equipped with an entire outfit of porcelain and vulcanite who encourage our patients with the good tidings that their newly acquired teeth function much more satisfactorily than did their natural ones. One disaster after another had befallen their ill attended teeth, until discomfort overcame their usefulness, and this final comparison resulted. Therefore, it is the dentist's business to discover and eliminate these destructive influences that occur in the history of each patient's teeth, and the prosthetic dentist must be equipped to preserve, as much as possible, what is left when his services are sought. Hence we study and experiment and compare our views, hoping some future good may be derived from our efforts.

I do not mean to say that all bridges should be removable, but I wish to set forth the advantages of removable bridgework when it can be employed.

There are times when plates, partial dentures and fixed bridges are indicated, and there are conditions making the use of removable bridges inadvisable, one of which is lack of skill on the part of the operator; and another, lack of knowledge on the part of patients of the value of this work, when indicated, which may threaten the adequate compensation of the dentist.

Partial dentures are indicated when teeth have been recently extracted, and reestablishment of the ridge is awaited; when the patient cannot endure the necessary preparations for bridges; when diseased conditions of the mouth are being treated with further changes impending; when muscular attachments will not interfere, and when there are no cavities in the adjoining teeth, and there is a favorable prospect of support by suction. Their disadvantages are: difficulty of unharmful retention; the presence of foreign material in the palatal and sublingual region, and difficulty in achieving an esthetic appearance.

Fixed bridges are indicated when the patient's mouth is healthy and not susceptible to pyorrhea or caries; when the abutment teeth are sound and the attachments can be made to cast crowns and inlays, and when the patient does not wish to be troubled with too much attention to his teeth or cannot afford the additional expense of removable restorations. Banded crowns and shell crown attachments should be avoided, and the design should promote ease of cleansing. The disadvantages of fixed bridges are: the difficulty of preserving hygienic conditions and of repairing the bridge; the temptation to leave them too long in place, causing loss of the

Fig. 3.—Adaptability of Nature (from a roentgenogram).

abutment teeth, and the fact that the abutment teeth, held rigid, must bear the stress of mastication, which falls on all the occlusal surfaces that they are required to support.

Removable bridges are indicated when it is desired to restore completely the anatomic shape of the oral cavity; or to relieve the abutment teeth of *all* of the stress of mastication and distribute it along the ridge; when it is advantageous to permit individual motion of the abutments, thus overcoming strain on the pericementum; when it is desired to make repairs with the least difficulty; when it is considered necessary that the supporting teeth be as easily and thoroughly cleaned as any teeth in the mouth, which, I think, cannot be said of any fixed bridge, and when it is desirable to raise the bite to regain lost space or to facilitate regulating. The disadvantages of removable bridges are: the exacting requirements of construction; the sacrifice of strength that must be made to their mechanism; the expense attending their construction, and the restraint required while teaching patients of indifferent mental attitude to become used to them. Elderly patients who have taken weeks, sometimes months, to learn how to manipulate their removable bridges at once acquire a greater admiration for their own skill in being able to replace the bridge without a mirror, than for yours in having been able to construct the appliance. When the adjustment, which cannot always be made at once, is not complete and the bridge comes out at a dinner party or lands on the floor of a hotel dining room, the patient comes back in wrath at the embarrassment you have caused him, and your thoughts revert to the safety first (to the dentist) of rigidly cemented bridges. But, on the whole, removable bridgework is a great success and the satisfaction to the patient in most cases, and the value of your achievement in making a removable bridge affords considerable compensation. It is not any more difficult

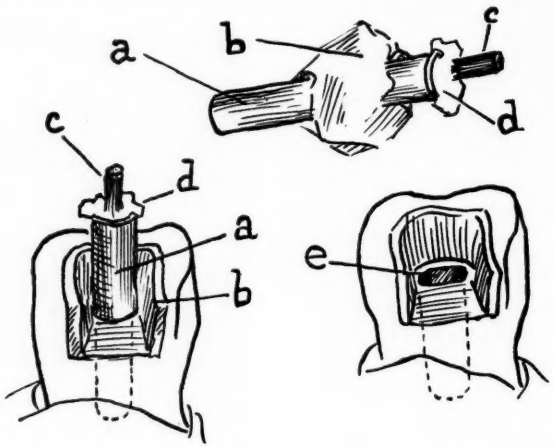

Fig. 4.—*a*, tube; *b*, inlay wax; *c*, graphite; *d*, investment; *e*, tube for split pin in finished filling.

to acquire the technic of removable bridgework than that of a good condensed gold filling, but the latter is required of us before we can receive a license to practice dentistry and the former is left to our volition.

Since it is impossible to give a comprehensive discourse on removable bridgework in less than a large sized volume, we will consider, as briefly as possible, a few points.

The attachment most adaptable for use in pulpless teeth is that known as the split pin and tube. It is best to make use of the manufactured tubes, but far better, when possible, not to use the manufactured split pins but to make them of the same gage of half round iridioplatinum wire. These are stronger and more elastic, and cannot be melted by excess heat, during casting and soldering operations.

The first proceeding consists in making a hollow cast gold inlay with the tube attachment for the reception of the removable inlay and split pin. The cavity is prepared in the tooth with a view to exposing as little of the attachment as possible; of getting sufficient retention, and of making the fixed inlay large enough for the mechanism it is to receive. When the cavity for the inlay has been prepared, the root canal is enlarged sufficiently to receive the tube. The tube is then filled with investment compound, with a small piece of graphite projecting, and this is allowed to harden. (Fig. 4.) Sufficient wax for the inlay pattern is attached to the tube; it is inserted, the tube entering the enlarged root canal at the proper angle, and the wax is pressed into place. This is removed from the tooth, and the

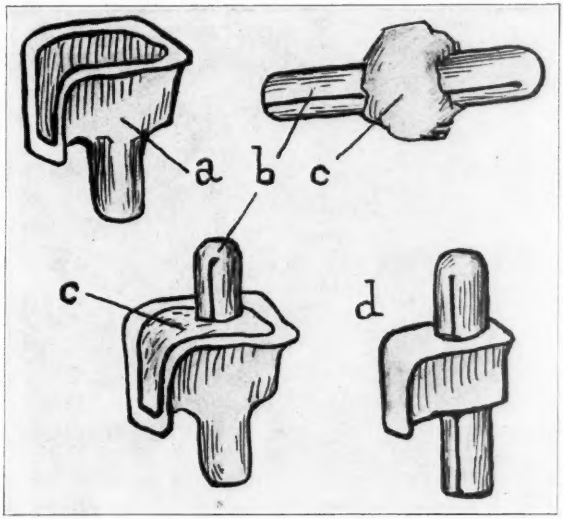

Fig. 5.—*a*, tube cast to hollow inlay; *b*, iridioplatinum split pin with mica inside; *d*, casting for removable attachment.

outline of the removable inlay that is to fit into it, and that will be cast to the split pin, is marked out with a sharp point, and the wax hollowed out down to the tube. It is replaced in the cavity; the edges are refitted, and a sprue is attached to one of the outer margins, at the angle most suitable for casting, when the piece is removed and cast. After casting, this fixed abutment is completed by cutting out the projecting part of the tube and finishing the shape of the inside of the fixed inlay with a large fissure bur. When this is completed and finished (Fig. 5), it is very delicately coated with petrolatum or oil on a small cotton pellet, then the pin carrying the wax for the inlay pattern is inserted. A little sticky wax may be fastened to the pin at the proper place, so that the inlay wax will more readily adhere to it. This pattern is so shaped that, when cast, it may be easily attached to the bridge and it will also complete the occlusion of the tooth surface when finished. Before investing, a fine piece of mica is inserted between the halves of the split pin and trimmed down with scissors, which will prevent any gold from uniting the two parts of the split pin and is a good method of procedure in any soldering or casting operation in which split pins or split springs are employed. The mica is obtained from discarded electric light fuses. The split pin and inlay fitting into the hollow inlay and tube insures a good attachment for use in pulpless teeth. (Fig. 6.) When the entire occlusal surface is gone and the tooth is very much broken down, the fixed abutment that is to contain the tube should not be built up to the occlusal line. The occlusion is then completed by the removable part of the bridge attached to the pin. This is done so that additions can easily be made when the stress of mastication

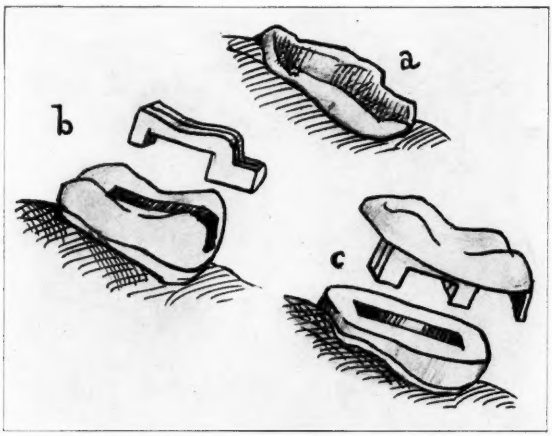

Fig. 6.—*a*, tooth with crown to be restored; *b*, wrong technic: removable attachment with occlusal part cemented fast; *c*, correct technic; occlusion on removable part of the bridge. (Illustrated with double spring instead of split pin.)

wears it down, or when it is desirable to raise the bite; while if the fixed part of the abutment completed the occlusion with the removable part set into it, it would be impossible to change the bite without removing the fixed abutment. This principle should be continually borne in mind in the designing of removable bridges: wherever occlusal deficiencies are to be restored, they should be included in the removable parts of the bridge; which is one of the reasons why the operator should be able to make his own attachments.

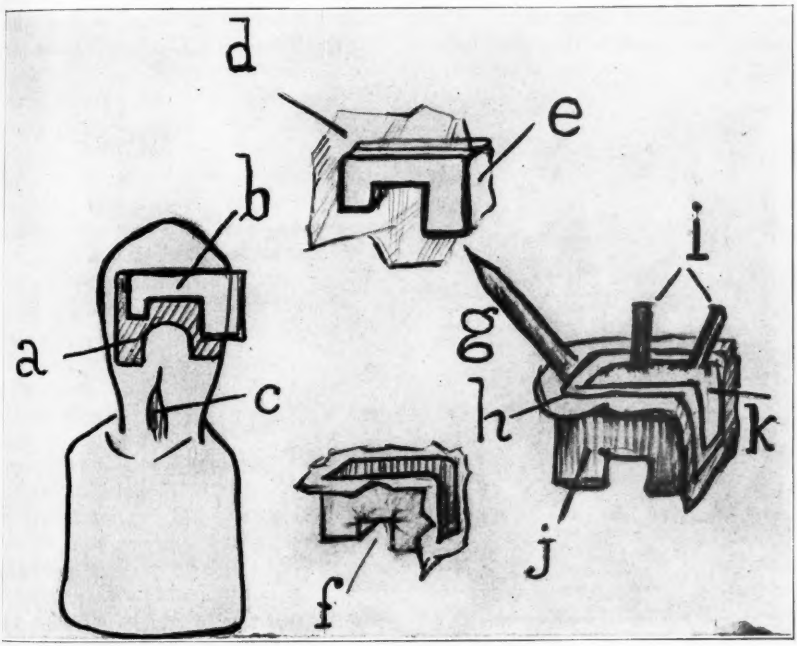

Fig. 7.—*a*, wax; *b*, clasp metal; *c*, pulp; *d*, mica; *e*, gold solder; *f*, platinum receptacle; *g*, sprue; *h*, platinum receptable; *i*, graphite; *j*, wax; *k*, investment compound.

The attachment for use in teeth with live pulps is a double spring, so shaped as to get the maximum friction and avoid encroaching on the pulp, the spring fitting into a little box that is cast into the inlay in a mesiodistal direction. This attachment can also be used in pulpless teeth, and the variety of its design is unlimited when the operator has become familiar with its technic. It can extend down into the pulp canal or follow any contour of the cavity, and it can extend through several adjoining cavities in other teeth when additional support is needed. These springs can be made also to extend linguobuccally, but for several reasons it is preferable in most cases to extend them mesiodistally. One reason is that there is less liability of exposing the pulp; another is that there is less display of gold, in addition to which it is easier to join the

springs from one tooth to another, where adjoining teeth can be used for anchorage, and also there is less likelihood of weakening the buccal walls. This again shows the advantage of being able to make the attachments to suit the case.

I will describe the method of making the simplest form of this double spring for a tooth with a vital pulp, as tween them to prevent the solder from flowing in. This solder, which should be high fusing, so that it will not be disturbed later, is at the end of the spring where it will join the bridge. Then the spring is carefully finished to the proper shape and a piece of platinum foil, one one-thousandth inch, is burnished around it to form the box with the top left open. This box is to be cast

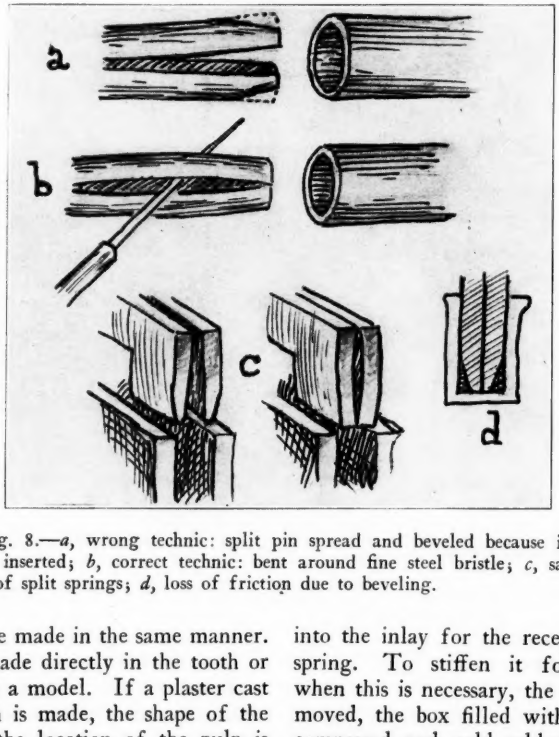

Fig. 8.—*a*, wrong technic: split pin spread and beveled because it could not be inserted; *b*, correct technic: bent around fine steel bristle; *c*, same example of split springs; *d*, loss of friction due to beveling.

all others are made in the same manner. It can be made directly in the tooth or indirectly in a model. If a plaster cast of the tooth is made, the shape of the cavity and the location of the pulp is noted, the spring being so shaped that it will fit into the inlay and avoid the pulp. (Fig. 7.) Casting clasp metal is used just as it comes from the manufacturer. Two pieces the proper size are soldered together with 20 carat solder, with a small piece of mica be- into the inlay for the reception of the spring. To stiffen it for handling, when this is necessary, the spring is removed, the box filled with investment compound and gold solder allowed to flow in a thin layer over the outside. The spring is then fitted into it and their proper relations are obtained. In this way, any required shape of springs and box can be readily made; instead of shaping the cavities to fit the attachments, as is often the case otherwise,

the operator is adapting his attachments to the forms of the cavities.

The cavity in the plaster tooth is then filled with inlay wax, and the receptacle for the spring fitted into it in the desired position. To cast this, and keep the proper relations between the inlay and the platinum box, it is necessary to place a little investment in the platinum box and insert one or more pieces of graphite in the investment, allowing it to harden. These pieces of graphite, obtained from mechanical pencils, will be engaged by the investment when casting, and will thus keep the box or receptacle in place when support furnished by the inlay wax is gone. Before this wax pattern with the box in place is cast, it should be tried in the cavity and the edges burnished to the natural tooth. The proper place should always be chosen for attaching the sprue, so that the casting gold will easily reach all parts of the mold. When this inlay containing the box is completed, the split spring is fitted into it in such a manner that it may be easily withdrawn for the subsequent work on the bridge. When a split pin attachment is made use of, it too should be adapted to its socket so that it may be easily withdrawn—for the friction that is to hold a removable bridge in place should not be apparent during its construction or it will interfere with the accuracy of the procedure. When the bridge is completed, the friction should be supplied by the operator. Split pins should be spread at the middle of their extent, and not at the end, by placing a steel bristle between them and squeezing the ends together with a pair of pliers. (Fig. 8.) If the work has been accurate, the amount of spreading need be scarcely perceptible to the eye; likewise, the spreading of the split spring should be made so that the first part to enter the fixed abutment has been unchanged, while the spreading should be done toward the central part of it, so the patient, when replacing a bridge, is able to find the place for the attachments without having them beveled, which causes a loss of friction. Figures 9 and 10 show examples of the adaptability of mesiodistally extended springs.

The next step in making a removable bridge is the construction of the saddle. This may be either cast or swaged.

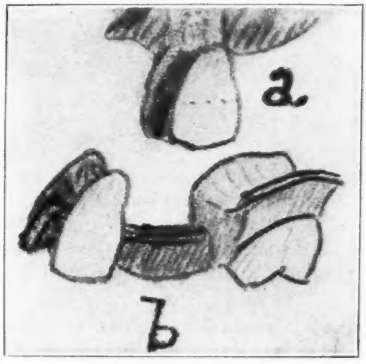

Fig. 9.—*a*, cast crown with receptacle for spring; *b*, double spring supporting two teeth.

Since a swaged saddle must have rims cast and soldered to it before completion, it is perhaps easier to cast the entire piece, for although a swaged saddle is necessary in the first step of making an entire cast saddle by this method, it involves less effort to cast the saddle and rims in one piece than it does to cast or solder rims to the swaged saddle.

The method that I think in time will appeal to most operators is as follows: first, a swaged gold saddle is made, tried in the mouth and adjusted to the ridge, so that it will permit sufficient pressure on test, and its edges will be on the line of the shape of the mouth before the

teeth were extracted. (Fig. 11.) Then, when built upon, the structure can be made to conform to the original shape of the mouth. When this saddle is satisfactorily shaped, it is placed in position in the mouth; the proper amount of pressure is applied to it to overcome the elasticity of the gums, and an impression is taken. Then a plaster model is made from this impression with the gold saddle in place. When this model is hard, the gold saddle is removed from it. Thus, a model is secured representing the condition of the gums in which they can best stand stress, and, on this, the wax pattern for

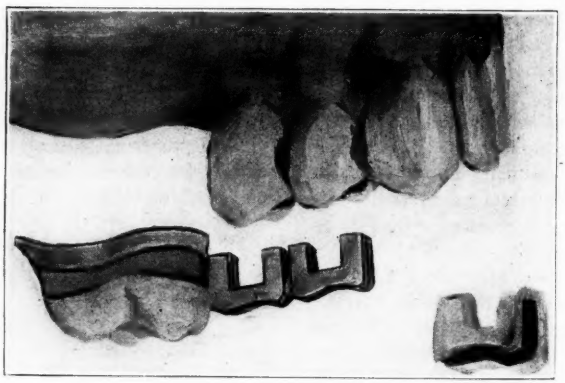

Fig. 10.—Another application of split springs, supporting an upper molar with attachments in two bicuspids.

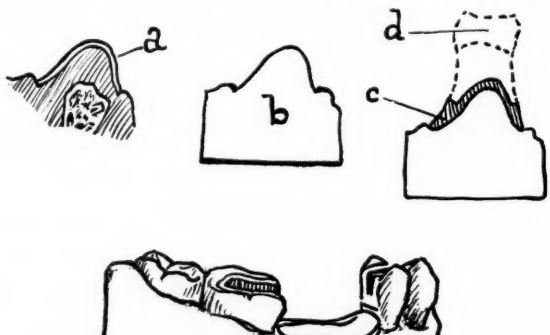

Fig. 11.—*a*, sectional view of swaged gold saddle pressed into gums to overcome elasticity while impression is taken; *b*, plaster model with gold saddle removed; *c*, wax form for cast saddle; *d*, outline of finished bridge for guiding shape of wax pattern; *e*, saddle and fixed abutments in place.

the saddle with the rims and attachments is made, and the saddle cast.

The next step is to fasten this saddle to the spring attachments in accurate relation to the abutments. This may be done with impressions of plaster or modeling compound in various ways that are all known to the prosthetist. The method that seems to give the greatest accuracy is as follows: The abutments are placed in the teeth and the removable parts are placed in position in the mouth. With sticky wax, a piece of German silver wire is firmly fastened to the removable attachments, then another piece of the same wire is fastened between the middle of this piece and the saddle. (Fig. 12.) These wires should be sufficiently long to permit bending without moving the attachments. This model is removed from the mouth and invested in such a way that all the parts will be held in place, so that low fusing gold solder can be substituted for the wax. When this has been done, it is put back into the mouth and the wires are bent until each piece is in its desired position, accurate fitting of the attachments and the desired position of the saddle being obtained by bending the wires. It is then taken out and reinvested in such a manner that when the low fusing solder is melted and the wires removed, the remaining parts of the bridge are in their proper places, ready for 18 or 20 carat solder. In many cases, it is easier to solder and adjust the wire connecting the springs before attaching the one to the saddle. If one has not been sufficiently foresighted to have the saddle and the removable attachments approximating closely enough to be easily soldered, pieces of plate gold or, better, platinum foil—properly inserted with sticky wax before the final investment, will fill the discrepancy. These are then soldered together, and the most important task in making the bridge is accomplished: the establishment of the relation of the saddle to its attachments.

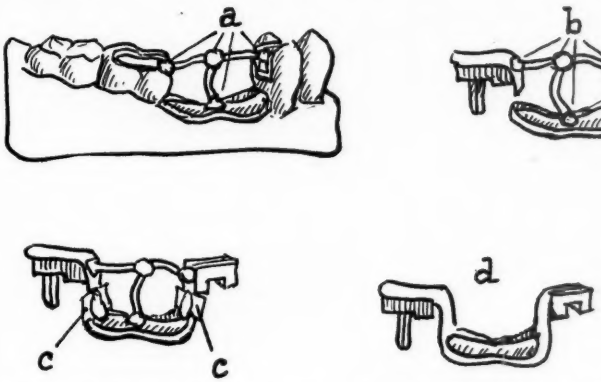

Fig. 12.—*a*, sticky wax holding wires, removable attachments and saddle in position; *b*, 14 carat solder replacing wax; *c*, pieces of gold or platinum held by wax to bridge discrepancy, the saddle having been fitted to the ridge and the springs to their sockets by bending the wires, investment following; *d*, finished framework ready for the teeth.

Teeth may be fastened to this saddle to be used by the patient temporarily, with base plate guttapercha, if the heat is properly handled. (Fig. 13.) This is done to establish the proper occlusal line, and to see if any changes occur in the tissues. While of course it is not always necessary, when there *is* need of it, this is a very good preliminary in accustoming the patient to the bridge and it often obviates revulcanizing or recementing the teeth, if changes subsequently must be made. When the opposing teeth have protruded beyond their occlusal plane, they may be forced back quite a distance by adding from time to time to the guttapercha attachment. When posterior teeth are missing and there is insufficient space for replacing them, space can be regained with a one end attachment to the saddle by employing guttapercha in this manner, gradually building it up. The principal achievement in making a one end attachment is overcoming the elasticity of the gums, and getting the proper relations of the spring attachment and saddle to prevent leverage from damaging the abutment tooth, which is accomplished as previously described with soldered wires. (Fig. 13 *b*, *c* and *d*.)

The successful use of clasps depends largely on physical conditions. In making removable bridges with clasps, good results are obtained when there are no cavities in the adjoining teeth and no tendency toward erosion or recession of the gums, and the patient does not mind their appearance or unnatural contour. Of course, as in all other forms of dentistry, the degree of success depends on the knowledge and capability of the operator. A good method for making clasps, devised, I think, by Dr. Roach, is to shape the pattern in wax directly on the model of the tooth, the model being made of investment compound from a plaster impression. With the wax pattern on it, the model is put in a casting ring; additional investment is filled in, and it is then cast. This procedure gives perfect adaptation to the tooth. Clasps should be thin enough to have perceptible springiness; long enough to encircle

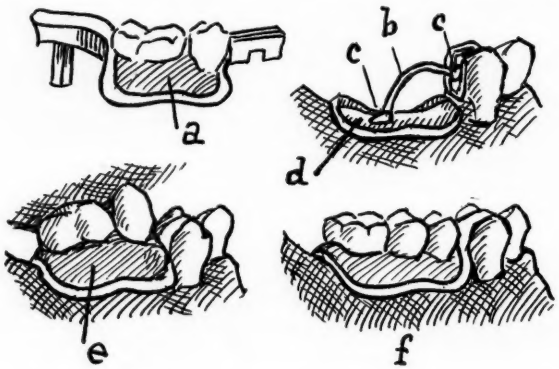

Fig. 13.—*a*, guttapercha; *b*, German silver wire; *c*, solder; *d*, saddle; *e*, guttapercha for building up to open bite; *f*, bridge finished with porcelain or vulcanite.

more than half of the tooth mesiodistally, and so shaped that their concavity engages the convexity of the tooth below its greatest diameter linguobuccally. (Fig. 14.) The latter is very important as it determines the amount of resistance the clasp will have to force tending to dislodge the denture. The continual downward pressure of the clasp will in some cases cause shrinkage of the alveolar ridge unless a lug is extended over the occlusal surface of the tooth, restricting the downward pressure *beyond* the point of overcoming the elasticity of the soft tissue.

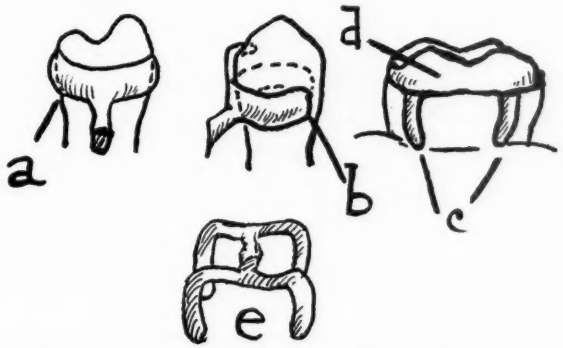

Fig. 14.—*a*, clasp extending below widest diameter buccolingually; *b*, clasp extending more than half way around the tooth; *c*, vertical clasps; *d*, cast crown; *e*, vertical clasps without crown.

Vertical clasps are very effective, especially when the bite is to be raised. They can be made of casting clasp metal and the occlusal piece cast to them afterward, or the entire piece, the raised occlusion and clasps, can be made in one casting, of casting clasp metal. This is often very helpful in changing the bite for regulating the teeth, and for the attachments for removable bridges, when raising the bite is also indicated.

A good use of clasps for holding in place a lower denture, which is much like a removable bridge, is to make a wax pattern of a lingual bar and two clasps and cast them in casting clasp metal all in one piece. (Fig. 15.) This bar is made to fit the teeth and gums closely where they meet, presenting a flat surface to the tongue. To this bar, saddles are attached in the manner described before, and the teeth are fastened on with guttapercha until occlusion is established; after which, the denture may be completed by fastening the teeth with vulcanite, casting gold or porcelain.

To remove teeth from any removable denture when fastened on with vulcanite, the entire block, teeth and vulcanite are covered with plaster, which is permitted to harden. Then the saddle is heated from beneath with a blow pipe and the entire block of teeth and vulcanite can be removed without distortion. After the repairs are made to the metal framework, this block may be cemented back in place. Teeth fastened with cement or baked in a porcelain block may be removed by boil-

ing ten minutes in nitric acid, which will effectively dissolve the cement, repairs being made without danger of fracture, after which the teeth or blocks can be recemented.

Removable bridges can often be employed to advantage in the regulating of the teeth, as they can be removed for cleanliness and for gradually raising the bite, while at the same time, they furnish the patient with ample masticating surface. Figure 16 shows an example of the use of removable bridges in regulating. The patient, who was more than 55 years of age, had been advised at various times not to have the teeth regulated. Finally, the lower teeth began cutting into the palate, making a serious lesion, which caused considerable alarm. Instead of cutting off the teeth as requested, I obtained permission to raise the bite with removable

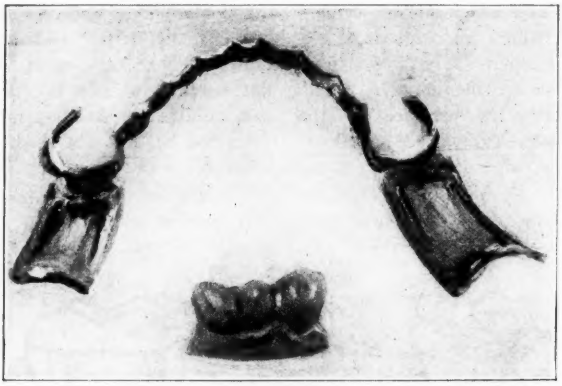

Fig. 15.—Cast lingual bar; clasps and saddles; porcelain block to complete denture.

Fig. 16.—Use of removable bridges in an orthodontic case.

bridges and to put a retraction arch on the upper teeth. In ten months, the patient, whose teeth had been very irregular, had a fairly good looking set of teeth, and the lower anterior teeth were unable to do any damage to the roof of the mouth. (Fig. 17.)

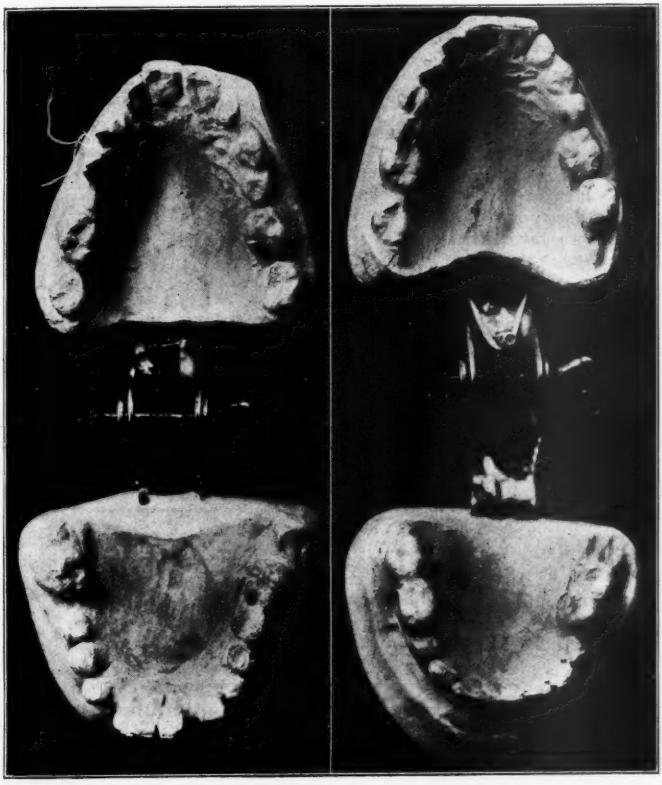

Fig. 17.—Use of removable bridges in an orthodontic case.

A new phase of construction, which I hope is a step forward in bridgework, is the two part or sectional removable bridge. Let us consider a case like that shown in Figure 18 (and such cases are not uncommon): To make a fixed bridge or a removable bridge, the teeth must be cut down at the continuous lines, with a sacrifice of much tooth structure and discomfort to the patient. To make a partial denture or bridge without cutting away the teeth, we must be limited to the dotted lines, leaving unnatural spaces where food can collect. By making the removable part of the bridge in *two sections*, the entire anatomic shape of the mouth can be restored both lingually and buccally; the undercuts can be filled up without loss of tooth

structure, and individual motion can be secured for each abutment tooth, in addition to the other advantages of removable bridges previously cited. The first section fills in the larger undercut

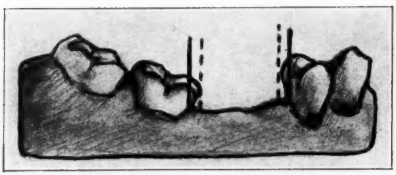

Fig. 18.—Continuous lines show necessary cut for ordinary removed or fixed bridge; dotted lines show spaces left if there is no sacrifice of tooth structure.

and forms the saddle. It is shaped in wax and cast after the fixed abutments are completed. (Figs. 19-20.) The principal point in its construction is that the lines for the reception of the second part must be made parallel to the movement of the retaining device. These abutments may be prepared for split pin and tube, or the vital pulp attachment, as the case may indicate, or at one of the ends, as in this case, merely with a telescoping inlay. The second piece supporting the artificial teeth and fitting into this one completes the shape of the

Fig. 19.—Fixed abutments for sectional removable bridge.

bridge and locks it in place. (Fig. 21.) Whenever possible, I use plain vulcanite teeth, cutting them to form a column of porcelain supporting the crown. Then, instead of having the gold extending into the porcelain, as in most manufactured teeth, we have the porcelain extending into the gold, which lessens the weight and also affords more approximal surface for casting or soldering together the metal parts of the bridge. When the bridge is satisfactorily adjusted and finished, the teeth are cemented in place in the casting.

Split inlays, made of casting clasp metal, are often valuable additions to removable bridges. They can be shaped to follow the contour of a cavity and are made as follows: The hollow inlay is cast (Fig. 22), finished, and half

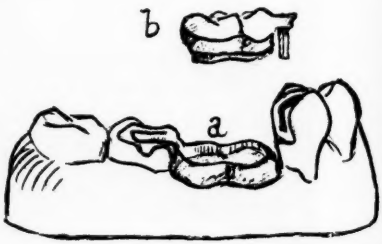

Fig. 20.—*a*, the first removable part in place filling the undercut of molar; *b*, the second removable part locking bridge in place.

filled with inlay wax. This is cast, finished and replaced in the inlay. The other half is then filled in with wax and cast separately. When these two are adapted to the cavity, a fine piece of mica is placed between them and the outside ends are soldered together. Used properly, these inlays, which should be as nearly square as possible on the bottom, will give added stability to the bridge.

Two part removable bridges have been thoroughly tested and meet every practical requirement. Figures 23, 24 and 25 show a series of roentgenograms of a sectional removable bridge

that has been in continuous use for more than four years and is kept in place by one spring attachment (a split pin) in a weakened tooth. The dotted line shows the direction the pin must take to avoid the bicuspid in front of it. This also illustrates the conical fixed abutment, which telescopes into the anterior tooth of the removable part, thus getting plenty of friction for the split pin without going roots is to fasten the split pins to the fixed abutments, having the tubes as part of the removable bridge. These two methods have been used advantageously in many cases.

CONCLUSION

I wish to emphasize the advantages of two part or sectional removable bridges. They can be fastened to either pulpless teeth or vital ones. The at-

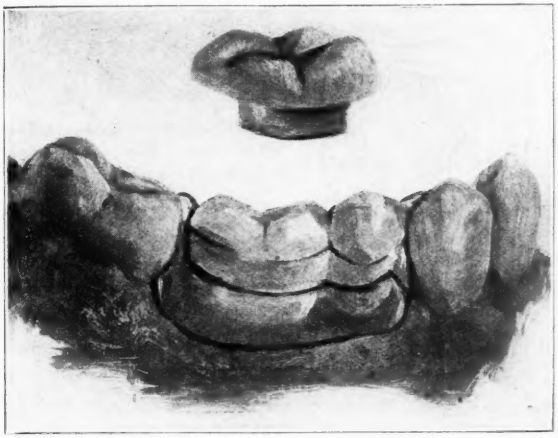

Fig. 21.—Two part or sectional bridge in place securing anatomically correct restoration, lingually and bucally; freedom of motion of abutment teeth; distribution of stress along ridge relieving abutment teeth, etc.; also showing method of shaping porcelain teeth to lessen weight.

very far into the root. The first removable part (Fig. 24) is a saddle with a gold inlay telescoping into a fixed inlay in the molar tooth. This piece closes the undercut in front of the molar and secures a line of movement for the insertion of the second part, which is parallel to the line of motion of the split pin, represented by the dotted line. (Fig. 25.) The second part fits into this one and carries the teeth and locks the bridge in place. Another effective attachment for frail or curved tachments do not have to be parallel and the inclination of one or both of the abutment teeth is an advantage in retention. The varieties of design are limited only by the ingenuity of the dentist. The individual motion of each abutment tooth contributes to the length of its usefulness. The distribution of the stress of mastication on the gums relieves the abutment teeth of more than their share. The absence of undue pressure, except during mastication, lessens the possibility of shrinkage of the

ridge. Avoidance of any protruding parts in the fixed abutments makes cleansing as easy as in the case of the

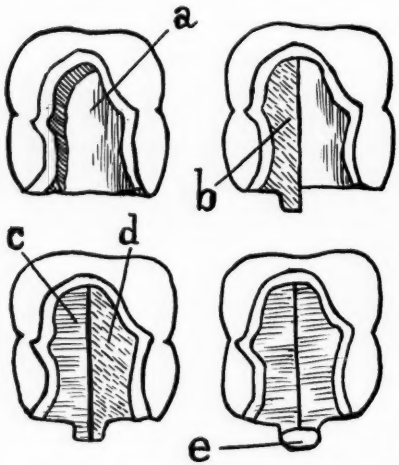

Fig. 22.—*a*, hollow inlay; *b*, wax pattern in half of inlay; *c*, clasp metal casting; *d*, wax pattern of other half of inlay; *e*, solder uniting parts of split inlay.

natural teeth, and repairs and changes in occlusion are comparatively easy. The outlines of the shape of the restoration can be made to conform with

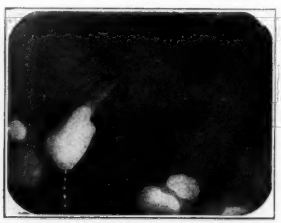

Fig. 23.—Abutments of two part or sectional removable bridge.

the original structure of the mouth; restorations for the anterior teeth can be made to resemble the natural ones, and, in most cases, the attachments may be concealed.

We should encourage our patients to try to go through life without losing any teeth, but as this cannot always be done, it will, for some generations, be

Fig. 24.—First removable post in place. Dotted lines show direction of split pin holding second post.

well to educate them as to the advisability of having their dentures *removable* as far as possible. It will also be advisable to have our oncoming generation of dentists so instructed that they will be able to meet this need. We make partial dentures and fixed bridges when indicated, but as long as the human race must resort to artificial restorations of the teeth, removable bridges

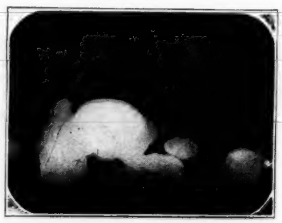

Fig. 25.—Second part of bridge in place.

will contribute more to the realization of the vision of Dr. Samuel Fitch than any other product of prosthetic dentistry that we have as yet devised.

DISCUSSION

H. E. King, Omaha, Nebr.: Dr. Moffitt is to be complimented particularly on the ingenious devices he has worked out for attachments in partial denture work. To me, they are new, and we are fortunate to have men willing to work out such things and to attempt to prove their practicability. I appreciate most the work shown in which a two-piece bridge is made to place in the space where the abutment teeth are badly tipped into the space. It would be very serviceable in these cases. In one principle brought out, I would differ with Dr. Moffitt. It would seem that these pieces should not be made to close entirely the interproximal spaces. I believe that the general tendency is more and more to stay away as much as possible from the gingival portions of the teeth in all removable work. The pieces shown on the screen would seem to invite caries in this region. Partial denture work is being made more and more complicated. I have nothing against the split pin attachment. The general tendency seems to be to devise methods making it a little less complicated, and it seems to me that we might discuss the general principle of simplified attachments, of which I think the clasp idea the simpler as against the split pin and various other ideas for making a more complicated attachment. I simply wish to express a preference for the very simple form of attachment, the clasp as against the more complicated forms.

A short time ago, a man who would be willing to pay almost anything to have a comfortable appliance in the mouth came to me with an appliance with four delicate patented retainers, two of them broken. He remarked: "This is fine work, but it needs a service station. If I go away on a long trip, I have trouble." A simple form of clasp obviated his difficulties.

Willis A. Coston, Kansas City, Mo.: I am greatly in favor of removable bridges, when they are possible. It is a great step forward to try to put in a removable base rather than a fixed base. I don't know that there is any material difference in the various attachments. Dr. King spoke about the clasp attachment as being preferable to a more complicated one. When put in properly, they are all simple. A young man came to me one day with a beautiful removable denture, four perfectly regular wire clasps, and he showed it to me as a work of art. It looked very simple. I said, "Well, this is nice, but very simple." He said, "I want to show you my mouth." The mouth was anything but simple, the teeth standing every direction and each one at a different angle. He had used a little clasp surveyor which had made those clasps absolutely simple; and he put them in place as if it was the simplest kind of a case. It is true, I think, that all forms of attachments, if properly paralleled and properly placed when finished, are simple, regardless of the kind employed.

I am glad that physicians and dentists all over the country are engaged in the study of removable bridges and removable dentures. They are giving the subject much attention, and from this may come a standard method of denture construction which will do a great deal of good.

George B. Scott, St. Louis, Mo.: I want to enter a criticism of the partial denture work we have been having. We have been entering into it with a one track mind. If we are going to use the split attachment without trying to use it where it is needed, or the clasp without applying it where needed, we are failing to realize that there are many types of attachments and a combination of attachments that we can use. The point is, we must study the cases sufficiently to know just what type of attachment to use. My idea is to study our partial denture cases a little more before we attempt to make a restoration. Whether we use clasps or a combination in conjunction with inlays, our cases themselves will determine.

F. Ewing Roach, Chicago, Ill.: Dr. Moffitt displays great ingenuity. I want to recall to your minds a suggestion that he made when referring to the employment of the cast clasp and the combination of an occlusal restoration in opening the bite. And I want to emphasize the value of this method of opening the bite. I have had a great many of these cases in which the bite was opened in this manner as much as from one-fourth to three-eighths inch and jumped it an equal amount. I believe with Dr. King that these cases should be made as simple as possible, avoiding the use of too many clasps and the complication of using

vulcanite and gold combined in the short span cases, making them with one piece gold castings and loose pin crowns.

Dr. Moffitt (closing): Dr. King said that we should not fill the spaces that occur in our bridgework for fear of impinging too much on the gums. If in preparing for any filling, we keep on until we enter the pulp, we can make trouble. Similarly, to fill the space between the teeth completely until the gums are encroached on would be destructive. But if we fill these spaces as they should be, we have plenty of freedom of motion, yet food cannot get in and we have accomplished something that has not been done in bridgework before. As for paralleling the abutments, the main advantage in two part removable bridges is that we don't need to have the teeth parallel. The more they are out of a parallel line, the more we can make use of the wedge retention employed to keep the bridge from coming out. Two converging forces moving upward jam together. If we take the bridge sections out one at a time, they come out easily, but when force is applied to both, we cannot get them out.

It is much more difficult to make a good clasp for a tooth than it is to make one of these mechanical attachments. To make a good clasp, we have to avoid impinging on the gums; yet we have to make it hold by springing it below the greatest diameter of the tooth. There will always be a downward pressure on the gums, and to obviate that we have to put a little lug over the tooth. If we can do this, get support of the ridge and relieve the abutment teeth without causing absorption of the ridge, we are pretty good artisans. By swaging the saddle, shaping it to the contour of the mouth and pressing it on the gums, I get the best results. If I made cast saddles directly on the impressions from the gums, they were not so good, for when we put the gold saddle on the gums and press it down, the tissue is distributed over the alveolar ridge. Clasps are not quite so good as these spring attachments. When an assistant does the work, he has more trouble in making clasps than in making these devices. I try to get away from the manufactured attachments as much as possible, and find this is of advantage especially when I want to use two teeth in conjunction for the support of the bridge. I too think that we should vary our work to suit the case. Many times, we have to employ partial dentures without any clasp or anything of the sort. Often, we have to make fixed bridges, and there are other times when the best results are obtained from removable bridges, so we must adapt ourselves to these varying cases. Regarding the vertical clasps, I have tried them out and they are most successful. There is nothing complicated at all about this way of making bridges when once learned. Perhaps I have attempted to present too many subjects, but as I said, one could write volumes on removable bridges and not cover the subject. I simply mentioned a few of these things, but did not go into detail about them all. The use of porcelain attachments is a great advantage, as Dr. Roach said, because they are much lighter than anything else and it is necessary to use gold only when porcelain would be too thin. I merely mentioned vulcanite because so many dentists have to use it and it can be used effectively in this kind of bridge.

A CONTRIBUTION TO THE ETIOLOGY OF MOTTLED ENAMEL

By THEODORE B. BEUST,* D.D.S., M.D., Louisville, Kentucky

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

THE lesion here discussed has been known to American dental investigators for the past twenty years. Owing to the proximity of our meeting place to the districts in which it occurs endemically, this opportunity to present the subject appears especially timely; for certainly a number of you, experienced in the observation of these cases, will materially enrich our conceptions by commenting on the various aspects of the problem.

The profession and the residents of the afflicted districts are deeply indebted to Dr. Frank O. Hetrick, chairman of the Research Commission of the American Dental Association, for his persevering and determined efforts at securing, often under adverse conditions, the mass of data bearing on this disfiguring anomaly that we now have at our disposal. With the material thus far accumulated, the investigation can proceed intelligently.

In compliance with a commendable request made by the management of the research section, confusing terminologies and unexplained technicalities, with which the routined practitioner is prevented from becoming acquainted, have been eliminated from this paper.

The first systematic endeavor to investigate the affliction was undertaken by the Colorado Springs Dental Society in 1902.[1] Since that time, and up to the present day, a number of men prominent in research work have submitted notable contributions pertaining to its manifestations, incidence and etiology.

The first accurate statement regarding mottled enamel found in American dental literature is probably that of G. V. Black,[2] in 1916, the publication bearing the subtitle "An Endemic Developmental Imperfection of the Enamel of the Teeth Heretofore Unknown in the Literature of Dentistry." Black's attention was first drawn to this condition in 1906, through information received from dentists practicing in certain Rocky Mountain districts. He describes the lesion at length, it being from this article that we gain the only conception of the histologic appearance of the enamel that has heretofore being contributed. For those unacquainted with the literature or with the lesion itself, Black's description of two teeth that had at that time come into his possession will be valuable.

Labial Surfaces: (a) Abnormal white color resembling unglazed paper, a considerable portion of the surface being mottled with dark brown.

(b) The colored areas vary, both in degree and extent in the different cases, from normality (translucency) through the dull white and yellow to dark brown and black. The color occurs in spots and in lines.

(c) The enamel is normal in form. The surface or glaze of the enamel is complete as in normal enamel.

As will subsequently be shown Black's description of the enamel surface applies to the teeth then under observation. Later, it was

*Working under grant from the Research Commission of the American Dental Association.

1. McKay, F. S.: Cosmos, 58: 477 (May) 1916.

2. Black, G. V.: Cosmos, 58: 129 (Feb.) 1916.

shown that many specimens exhibit rough and pitted surfaces.

Lingual Surfaces: The lingual surfaces generally are opaque, paper white but mottled with normal spots or clouded areas.

Dentin: Normal.

According to Black, the essential malformation in this condition is the result of the failure of the cementing substances between the enamel rods in the outer one-fourth to one-third, more or less, of the enamel. The colored areas Black supposed to have been caused by the deposition between the prisms, in place of the missing cement substance, of a matter similar to the brown substance which he had succeeded in extracting from teeth taken from various sources and which he called "brownin." He found that the discolored enamel could be decolorized by treatment with alcohol and gasoline, and afterwards stained.

OPINIONS OF FORMER INVESTIGATORS

Black's views on the etiology of mottled teeth, excepting, perhaps, his ideas concerning the time of entrance of the discoloration, seem to be the conceptions generally held at the present day. His conclusions may be briefly expressed as follows:

(*a*) The condition (mottled enamel) is acquired during the growth of the enamel.

(*b*) Subjects afflicted with this lesion must (necessarily) have resided in the endemic localities during the growth of the enamel of the affected teeth. For instance, lesions affecting the incisors and first molars would indicate a residence in the endemic area between the first and fifth year or thereabouts.

(*c*) In endemic mottled enamel, the actual tissue of the teeth is stained during their growth. (This was subsequently modified by McKay[1]).

(*d*) The deformity extends from the surface of the tooth inward to about one-third of the thickness of the enamel.

(*e*) The lines and depths of the abnormal area has no reference whatever to the lines of accretion or growth.

Black pronounced it the "strangest thing in dental pathology."

Andrews says (1) "If the stain is within the enamel substance it must have formed there while the enamel was forming; that is, some unusual chemical combination may be formed with the lime salts and the blood, and this abnormal substance may cause the stain by being deposited with the lime salts in the ameloblasts, where it is elaborated into a pigmented structure." In making observations on some specimens shown him later, he expresses misgivings concerning his former conclusions by saying "The stain was not there when the tooth was forming, but is a stain that penetrated after the tooth was erupted."

McKay[3] is of the opinion that the damage is wrought by an influence that acts either in an inhibitory or in a destructive way on the enamel during or immediately after the building period prior to the eruption of the tooth.

Grieves of Holland (quoted from McKay[3]) is "decidedly of the opinion that thyroid disturbances, or at least underlying constitutional factors, will be found to contain the solution of the difficulty."

Harris[4] writes "The chief etiologic factor appears to rest with little deviation in the water supply, this water in my investigation being from mineral springs . . . . The teeth erupt in the mottled condition, but the brown color does not make its appearance until some considerable time afterward, and then coming on gradually."

The concensus of opinion gleaned from these and many other publications is that some obscure ingredient of the endemic water, acting through the blood

3. McKay, F. S.: Progress of Year in Investigation of Mottled Enamel with Special Reference to Its Association with Artesian Water, J. N. D. A., 5: 721 (July) 1918.

4. Harris: Cosmos, 66 (July) 1924.

supply, during the preeruptive development of the tooth, is the etiologic factor in mottled enamel. Logically, the earlier writers could scarcely arrive at any other conclusion than that the affliction occurred before the tooth was erupted. In fact, the hypotheses concerning enamel development and enamel biology then generally recognized would scarcely permit of any other view. Black's utterances, made near the close of his illustrious career, illustrate the conceptions of his time beautifully:

> A tooth that is misshapen, off color or otherwise deformed during growth, is in the condition of dystrophy.
>
> Dystrophies of the enamel consist of imperfections in development due to some disturbance of nutrition during the time of its formation and growth.
>
> Enamel undergoes no (physiological) change after the tooth is once erupted.
>
> We cannot stain the body of the normal enamel with any staining agent we know .... Even the anilin dyes dissolved in alcohol fail to penetrate it .... It is a solid and impervious to ordinary stain .... Any staining in the substance of the enamel is the result of imperfections in development which create openings which absorb the stain.

The quotations plainly indicate the line of thought emanating from the earlier contributors to our subject. The possibility that the erupted tooth might have been attacked by agencies acting from without was never seriously considered by our histologists.

This problem demands excursions into the ultimate intricacies of biology, pathology and chemistry. As years of research have failed to afford a solution, an attempt to approach the subject from another point of view will be undertaken.

VITALITY OF THE ENAMEL

Today, two conceptions concerning the state of the enamel of an erupting tooth stand opposed. One school of investigators, holding to the views of Hopewell-Smith, contend that the erupting enamel fails to receive nutriment, and is inorganic and inert; and that it is dead, nonvital and completely formed when erupted. The opposing view, that held by Douglas Caush and J. Howard Mummery, regards the enamel as a vital tissue, capable of metabolic modification. Mummery, foremost English dental histologist, who successfully adopted methods that I evolved in 1911 of inducing stains to permeate the enamel by capillary attraction via the dentinal tubules,[5] writes[6] "It does not seem possible to consider the enamel as entirely inorganic and impervious . . . it is evident that stains pass from the dentin and course in some areas in the majority of teeth." Again, speaking of enamel tubes (page 79) he writes: "It seems impossible to avoid the conclusion that these tubes have a calcifying function, conveying the lime salts to the organic foundation substance of the enamel previously laid down." Mummery states that the determination of the penetrability of enamel appears of more importance with regard to caries than the proof of the persistence of solid organic matter or the presence of gross defects of structure. The question of penetrability applies equally well in the determination of mottled enamel. Although it must be admitted that all authors are not yet in conformity, so much proof of a permeability and an inherent vitality of the enamel has recently been introduced[7] that no more doubt is left as to the inaccuracy of the statements that enamel undergoes no physiologic change after the tooth is once erupted, or that normal enamel cannot be stained. The results of Percy R. Howe's experiments also point to a fluctuating susceptivity or

5. Beust, T. B.: Cosmos, 54: 659 (June) 1912.

6. Mummery, J. H.: Brit. Dent. J., 43 (July 1) 1922; Microscopic and General Anatomy of the Teeth, 1924.

7. Beust, T. B.: Dent. Summary, 44, 1924; Physiologic Changes in Structure of Enamel After Tooth Eruption, J. A. D. A., 11: 396 (May) 1924. Boedecker, C. F.: Permeability of Enamel in Relation to Stains, J. A. D. A.; 10: 60 (Jan.) 1923. Rickert, U. G.: Evidences of Structural Changes of Enamel, J.A.D.A. 11: 391 (May) 1924.

resistance displayed by the external covering of the teeth, indicating, of course, a vitality resident in the enamel.

The enamel of a tooth at the time of normal eruption is, as I have previously demonstrated, in a semicalcified (mesiotrophic) condition, displaying a relatively high susceptivity to acids and to permeation by stains. The enamel rod-substance, at this stage, may be permeable for stains. From the mesiotrophic condition, the enamel passes on to the mature (telotrophic) state, in which it displays a relatively high resistance to the attacks of chemicals and to the entrance of stains.

These observations lead the investigation of mottled enamel into an entirely new trail. I propose to submit evidence that the lesion may be produced by direct injury or trauma caused by the action of the endemic waters through their contact with the young newly erupted enamel and furthermore that the characteristic histologic changes found in mottled enamel can be duplicated experimentally on teeth outside the mouth. In these experimental teeth, the mode of penetration of the enamel by the agents producing the experimental mottling, as seen under the microscope, is similar; the characteristic attack on the prisms is similar, and the result, barring colorations due to the environment of the teeth in the mouth, is similar to that seen in the naturally mottled tooth.

Mottling is simply the partial decomposition of the enamel, including its constituent rods, by an acid. Caries-free teeth obtained from infirmary patients and which have been preserved since their extraction in a 4 per cent solution of liquor formaldehydi were used in the experiments. Material of this kind usually contains a large percentage of teeth showing periodontoclasia. Such teeth are known to be especially resistant to acids and other agencies operating in their destruction. Newly erupted teeth, therefore, would be more profoundly affected.

OBSERVATIONS SUPPORTING A CHEMO-TRAUMATIC HYPOTHESIS

Some published observations indicating an attack on the already erupted tooth by the waters used for drinking purposes will now be considered. As will be seen, the exposed surfaces are the ones affected; the protected, that is the enamel covered by the lips or cheeks, being unaffected as a rule.

McKay says:

> In its usual manifestations, the stain is located on the incisal half of the surface, and as a rule the central incisors will have the most, the lateral incisors somewhat less and the cuspids still less or none at all. On the central incisors the stain may be on the middle of the labial surface; somewhat lower down on the lateral incisors and just on the points of the cuspids .... the bicuspids are not often discolored in any typical way .... the stain is located almost without exception on the labial surfaces of the central incisors.

W. B. Arthur[8] writes:

> With us the discoloration is most noticeable on the areas of enamel which are constantly or periodically exposed to the atmosphere, and the more habitual the exposure, the greater the discoloration; for instance it is more common on the labial surfaces of the incisors, tips of cuspids and bicuspids, gradually lessening from the centrals backward as the downward curvature of the lip leaves less of the tooth exposed."

McKay later observed:[9]

> How shall we account for the lowers escaping when both groups of teeth are formed at the same age and we may assume under the same conditions, and yet this apparent discrimination of the location of the stain is not only common but the rule. There are but few exceptions .... no matter in what part of the country it is found to exist, it always takes on the same characteristic appearance and is distributed upon the same areas of the teeth in typical fashion.

Gasperini[3] says: "The discoloration presents itself everywhere in the same way, for which the cause must be identi-

8. McKay, F. S.: Cosmos, 58: 627 (June) 1916.

9. McKay, F. S.: Investigation of Mottled Enamel and Brown Stain, J.A.D.A. 4: 273 (March) 1917.

cal. The second teeth appear healthy but suddenly lose their translucency and become of white color."

Guerini, of Naples, writes:[10] "The spots are caused by the action of gases emanating from mineral springs and sometimes invade the entire free surfaces of teeth."

Harris[4] contends: "If afflicted persons leave these areas (endemic) we find that new teeth erupting show an absence of this malformation."

Many more references may be cited to show that the attack on the exposed enamel is the rule; indicating, of course, that the influences causing the changes in the enamel are of external origin. How are we to accept a theory that ascribes a developmental dystrophy or a metabolic disturbance during enamel formation to a clinical manifestation that is governed by the amount of exposure to which the teeth are subjected after their eruption; for instance, one that is influenced by the curvature of the lips?

Logical deliberation precludes any involvement of the enamel during the preeruptive stage that would create the microscopic appearance of mottled enamel. According to current theory, the enamel is deposited over the dentin in layers, the number of which is approximately forty. Now, if the agency producing the lesion acts through the blood stream during the development of one of these layers, it is inconceivable that the attack should occur on irregular or circumscribed areas of such a layer, as all of the then functional ameloblasts would be equally affected, creating a lesion corresponding to the extent of the layers. Black's contention that the anomaly has no reference whatever to the lines of accretion or growth is easily verified, as the lines of accretion, the so-called incremental lines, which correspond to the above mentioned layers, are plainly seen to have no influence as to the pathologic manifestation whatsoever. The attack begins in the outer layer, often from several irregular centers, piercing the underlying layers irregularly.

There can be no doubt that hypoplasia is frequently associated or confounded with mottling. There is little difficulty in differentiating between the two, as hypoplasia generally is attended by considerable tissue loss with relatively little disorganization of the remaining rod substance; while the mottled tooth generally presents an enamel covering normal in form, the prism basis substance of which has been rendered opaque and friable by the etiologic agency.

HISTOPATHOLOGY OF MOTTLED ENAMEL

As stated, G. V. Black attributes the deviation presented in mottled enamel to a failure of the interprismatic substance. This interpretation I have never been able to adduce from my specimens. Any substance permeating the enamel proceeds through the tubes or interprismatic substance first. Any destructive substance, such as an acid, will penetrate between and attack the rods from their approximal surfaces, the permeation of the tubes always being in advance of the lateral permeation of the rods. This is precisely the mode of attack of the agencies producing mottled enamel. It proceeds centripetally through the tubes as already described, attacking the rods as it pierces layer after layer of the tissue. The prisms in severely mottled enamel appear, individually and collectively, chalky white and are apparently partially decalcified. In mild mottling, the rods escape this complete alteration. If stained with alcoholic fuchsin, the altered rod substance appears red; which is contrary to the behavior of the prism substance in normal mature enamel, in which the prism ground substance is practically impervious. This susceptivity of the prism basis substance may be said to be diagnostic of the mottled condition.

In one of the eight mottled teeth sec-

10. McKay, F. S.: Cosmos, 58: 781 (July) 1916.

tioned, an unstained peripheral area corresponding in location to Nasmyth's membrane was found, the rods beneath being uniformly stained. In this case, the enamel substance removed appears to have dialyzed through the apparently unaffected outer layer.

MOTTLED DENTIN

The disorganizing influence on tooth structure of the agency producing mottled enamel is further evidenced by its action on the dentin. In cases in which all of the enamel layers have been pierced by the deleterious agency, we often find areas in which the amelodentinal junction has been passed, the line of attack evidently following the dentinal tubules penetrating the enamel. The dentin ground-substance becomes clouded, apparently decalcified, as it becomes exposed. Areas so affected absorb alcoholic fuchsin stain readily; which is contrary to the behavior of the dentin ground-substance toward this stain. This phenomenon presents a condition that may appropriately be called mottling of the dentin, its mode of origin and the characteristic clouding being essentially the same as in mottling of the enamel. A description of dentin so affected has never, to my knowledge, been reported on.

EXPERIMENTAL EVIDENCE

The condition termed mottling can be duplicated experimentally. That the enamel basis substance may be decalcified or otherwise altered sufficiently to become clouded and to absorb basic and acid fuchsin stain without at the same time being altered sufficiently to cause disruption of its constituent prisms, analogous perhaps to the state of the rods in incipient caries, may seem paradoxical. This disorganization with chemicals has heretofore been accomplished only by treating enamel imbedded in special supporting mediums. I have a number of sections prepared from mature teeth the results of a study of which may prove valuable to students of enamel caries. These teeth were first decalcified or altered by immersion in chlorin, sodium and sulphur mixtures, stained, sectioned and ground thin on stones, without precautions other than those exercised in the preparation of slides made from mottled teeth. Such altered enamel manifests itself as does mottled enamel, the initial attack occurring on irregular spots or areas, gradually affecting larger surfaces as the exposure to the agencies is prolonged.

Preparations demonstrating the relative susceptivity to stains and acids of young and mature enamel, respectively, are available for examination. The reported immunity to the etiologic factors of mottled enamel exhibited by temporary teeth and the mature enamel of adult teeth is thereby explained. The young enamel is more susceptible. My conception is that mottled enamel is enamel not yet fully calcified that has been attacked during or shortly after the eruption of the tooth.

If a section of a jaw containing both temporary (mature or telotrophic) teeth and some erupting or recently erupted permanent teeth is exposed to freshly prepared sulphur dioxid solution or to weak (0.5 to 0.1 per cent) hydrochloric acid for a short time, the decalcification of the permanent (mesotrophic) tooth will precede that exhibited by the more mature temporary teeth. If similar sections of jaws are exposed to the action of alcoholic fuchsin stain for ten days or more, the enamel of the erupting permanent tooth is seen to display more penetration than that of the earlier erupted and consequently more mature temporary tooth. These observations were made on dogs and pigs, and indirectly on human beings.

THE ENDEMIC WATERS

It is to McKay's diligent and painstaking work that we owe most of our knowledge of the incidence and manifestations of mottling of enamel, and of the en-

vironment of those persons affected. He has shown beyond a doubt that the lesion is associated with the drinking water. Recently, Dr. Frank Hetrick accumulated eighty-five reports of water analyses from endemic districts, making a total, together with those of Dr. McKay, of nearly 100 analyses. These reports, with few exceptions, indicate that the waters are mineralized to a considerable extent above the normal for other localities.

As I have never had an opportunity to visit a district in which mottling is endemic, my activities were confined to an investigation of the histologic changes attending the development of the condition; and furthermore the nature and sources of agencies that might produce such changes.

The water analyses available for study offer various possibilities for the occurrence of combinations that might affect teeth. In what proportion of wells such potent combinations may be demonstrated, it remains for a future special investigation to reveal. The chlorin and sulphur combinations appear to rank as prime factors in the mottling of the enamel. The presence of these substances in potent concentrations in these highly mineralized waters may be inferred from the fact that springs and even rivers may contain sufficient amounts of free hydrochloric acid and sulphur dioxid to produce mottling. For instance the Rio Vinagre of Mexico contains 0.091 per cent of hydrochloric acid, a concentration that will attack teeth. The same may be said of the Paramo de Ruiz in Colombia and the Devil's Ink-Pot in the Yellowstone; and the Brook Sungi Pait in Java carries a like amount. Generally speaking all waters containing sulphur contain or may generate sulphur dioxid or sulphuric acid. The former as is well known, occurs freely in numberless springs of volcanic origin. Geologic formations containing sulphur deposits are potentially acid producers, owing to the oxidation of the precipitated sulphur frequently contained. This is also decomposed to sulphuric acid by microorganisms.

There is more than a simple parallelism between the experimentally produced chlorin and sulphur mottling and the natural mottling process. At the present moment, I am disposed to consider the two identical, although it must be noted that similar phenomena may be produced with acetic acid and possibly many other acids. These observations demand further research along these lines.

Success at altering the enamel without destroying the anatomic integrity of the prisms appears to depend on the use of highly diluted mixtures extended over a considerable period of time. The result of such treatment is a dilatation of the enamel tube, which renders more visible the channels through which the osmotic flow observed by Bunting and Rickert must have occurred. This is followed by the attack on the proximal surface of the prisms, which become clouded and susceptible to stain. Finally, the exposure, if too long continued, will completely destroy the prisms. This complete destruction also occurs in naturally mottled enamel, denudation and the development pits and fissures being the result. Mottled enamel may react to stains in the mouth as it does under laboratory treatment, sulphur, iron and tannin combinations being effective in causing discoloration.

The nebulous state of our knowledge of enamel composition precludes present speculation concerning the nature of the constituents removed during the mottling process, the agents used possessing properties that will admit of modifications of either the protein or the mineral content. As the histologic and experimental investigation indicates that the enamel has been attacked by disorganizing agencies,

the following conclusions were formulated:

CONCLUSIONS

1. The lesion is not developmental, as has heretofore been commonly supposed. It is the result of trauma caused by the direct action on the enamel of agents contained in the endemic water.

2. The enamel of a tooth that has attained functional activity (alinement) offers a demonstrably higher resistance to acids and to permeation than that of one which is in the act of normal eruption. This explains: (*a*) the relative immunity exhibited by temporary teeth, which are not exposed to the water until long after their eruption; and (*b*) the relative immunity exhibited by the teeth of mature individuals.

Experiments.—The best experimental duplication of the mottled condition was obtained by the immersion of teeth in the first two of the following solutions: (*a*) Sodium bisulphite in 10.5 and 2 per cent aqueous solution allowing 50 c.c. of the solution for each tooth immersed. The receptacles were kept sealed. Exposures up to four months were examined. (*b*) Two grams of sulphur, burnt in a 2,000 c.c. Erlanger flask containing six teeth, which were immersed in 1,000 c.c. of water. The flask was loosely plugged with cotton wool. (*c*) Hydrogen sulphid solution in 1,000 c.c. of tap water kept in an open vessel. The only tooth used in this solution gave very good results.

The following solutions gave positive but variable results: 1. Hydrochloric acid, 0.1 c.c. of 37 per cent acid being used to 1,000 c.c. of water. Four teeth were used in this case. 2. Glacial acetic acid, used in 1 per cent solution, 200 c.c. to each tooth. 3. Chromic acid in 1 per cent solution.

The time of exposure for all of these solutions depends on the intensity of the stain desired, three days in the case of worn infirmary teeth being sufficient to show localized penetration. The H_2S tooth was not examined under three months. The hydrochloric acid and chromic acid solutions should probably be used more highly diluted.

Staining.—The teeth are first well washed (preferably for twenty-four hours) and then stained in 1 per cent basic fuchsin for from three to six days. More brilliant staining may be attained by passing the teeth through graded alcohols for ten days, with a subsequent ten day exposure to the stain. The naturally mottled teeth were stained according to the method last mentioned.

DISCUSSION

Percy R. Howe, Boston, Mass.: In looking into this pathologic condition that is so prevalent, it isn't well to draw any conclusions. We have to go slowly and base our conclusions upon the facts as they are developed. Dr. Beust has done another piece of admirable work and for the present I don't see how we can reach any other conclusion than that he is on the right track.

Edward H. Hatton, Chicago, Ill.: Of all the explanations of mottling of enamel that I have either read or heard, this is the most convincing, in that it supplies the explanation of things that before were not explained, and for the present, at least, I shall be satisfied to accept this as an added explanation on mottled enamel.

Dr. Beust, (closing): I was in hopes some remarks would be made concerning the possibility of elements in the water that might produce such changes. Of course, our conventional chemical analyses are a poor basis for conclusions. It would be impossible to see from the conventional analyses whether such potent combinations are really present because these analyses rarely give it. It is only by inference that we can arrive at conclusions.

THE AGE FOR ORTHODONTIC TREATMENT AS RELATED TO THE GROWTH OF THE FACE

By W. E. FLESHER, D.D.S., Oklahoma City, Oklahoma

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

A FEW months ago, a woman came into my office and said, "Doctor, my daughter's mouth has changed so lately, and seems to be growing worse all the time. The position of her teeth has begun to show in her face. The change was so gradual that I never noticed that anything was seriously wrong until some of our friends mentioned it. Of course, I took her to a dentist right away, and he referred me to an orthodontist. What can be done?" The daughter was perhaps 13 years of age; and this case is typical of those frequently met by the orthodontist.

Why are so many cases of malposition of the teeth discovered at about this age? In the growth of the individual from infancy to adult life, there are certain periods in which the growth is more rapid than in others. In the growth of the face, there are, also, certain periods in which the change is more noticeable than at other times. It is my purpose to make some observations along this line, and to note how the position of the teeth affects the shape of the face. I shall first trace the normal development of the teeth and face; next, the abnormal development, with suggestive orthodontic treatment.

During the child's early life, the face is usually quite plump, and gives little or no outward evidence of the eruption of the deciduous teeth. As age increases, this plumpness is not so noticeable. The dental structures develop in width with the eruption of the permanent incisors, and grow forward with the eruption of the first permanent molars. At this age, the average mother, on observing the permanent incisors, is surprised at their size, and fears that the child's teeth will be out of all proportion to the face.

Until now, the child's features have been shaped largely as is common in the baby face, but with the introduction of the permament incisors and the first permanent molars, a change begins to take place.

Much of the stimulus for the growth of the bones of the face comes from the development of the dental arches through the eruption of the permanent teeth, which is influenced not only by the function of the teeth and the jaws, but also by diet, sleep, exercise and sunshine.

In the normal development of the dental arches, and prior to the eruption of the bicuspids, a fulness of the alveolar process will usually be noticed above the deciduous molars, disclosing the presence of the bicuspids, and indicating that the time for their eruption is near at hand.

The position of the erupting teeth is slightly exterior to that of their predecessors; which shows a further de-

velopment in the width of the dental arches.

Owing to the later time for the eruption of the permanent cuspids, there is usually a lack of development in the cuspid region. But about the ninth or tenth year, on palpating over the deciduous cuspid, a prominence will be noted, which is due to the development of the cuspid eminence. The permanent cuspids and the eminences develop the angle of the dental arches, and the corners of the mouth.

It is noticeable that the normal erupting position of all of the permanent teeth is slightly labial, or buccal, as the case may be, to their predecessors, establishing the dental arches and the alveolar process of greater proportions.

Now, on the eruption of the cuspids, the full size of the dental arch in width anteriorly is completed. There is yet much depth to be established, through the completion of the formation of the roots, which causes a growth of the alveolar tissues in depth and width and serves as a further stimulus for the growth of the maxilla and mandible and other bones of the face.

The eruption of the second permanent molars at about this time establishes a greater width posteriorly, and, at the same time, sets the entire dental arch and alveolar process forward, giving added stimulus for the growth and development of the facial bones.

Usually between the twelfth and fourteenth years, and subsequent to the completion of the eruption of the teeth and the establishment of the normal dental arches, a more rapid and extensive facial change takes place than at any other previous period. The lines of the adult face are now being laid. As the dental arches deepen and are developed forward by the eruption of the third molars, the change in the features continues until adult life, in a normal, harmonious manner.

In considering the growth of the face toward the abnormal, we find there are two types that are early recognized; the first characterized by the prominent lower lip and protruding chin, with the linguoversion of the maxillary incisors; the second, characterized by the short upper lip, labioversion of the maxillary incisors and mouth breathing.

I have noted cases in children as young as 18 months in whom the linguoversion of the maxillary incisors produced quite a lack of development in the premaxillary region. This type is early recognized and should be corrected at as early an age as is practicable—most assuredly before the eruption of the permanent incisors. Thus, it is possible to avoid the extreme facial deformity that is present in these cases, if they are allowed to develop into the distinct mesioclusion type. Often, a mere change of the deciduous maxillary incisors from a lingual position to normal, as I said, as early as practicable, will in a short time correct the abnormal development and growth both in the premaxillary bones and in the face, since these tissues receive the stimulus of normal functional adaptation.

The other type of abnormal growth, that produced by the labioversion of the maxillary incisors, is also early recognized through its influence on the face. It is caused by adenoids and such habits as sucking the thumb, biting the lips and breathing through the mouth.

Here, again, corrective procedure should be instituted as early as possible to prevent the facial disfigurement that is peculiar to the distoclusion

class, and is characterized by the labioversion of the maxillary incisors and the short upper lip. Into this class, most of these cases usually drift. In many cases, before the eruption of the permanent teeth, malposition is chiefly in the incisal region, with the relation of the maxillary and mandibular arches, in the molar region, normal or practically so.

If these two types of malposition can be corrected during the life of the deciduous teeth, much abnormal development and growth in both the hard and soft tissues may be prevented.

We now come to a class of irregularities that is of most vital significance; for, if they are not recognized and treated at the proper time, the entire life of the patient thereafter may be seriously handicapped. It is a fact that most of these patients have had normal occlusion during the life of the deciduous teeth, with the facial lines possibly plump and harmonious.

We are now confronted by the incipient stages of almost every type of malposition and malrelation listed in orthodontic literature; and it is to this class of abnormalities that I wish to call special attention.

These cases are often overlooked in the early stages of their development. The face does not show any abnormality in the incipient stages because of the usual plump, childish features. But, with the eruption of the permanent teeth in malposition, it is recognized that beneath these regular features something has interfered with the process of the growth and development of the dental arches of the individual.

When these early stages of malposition are recognized, it is time for us to become concerned about the case, endeavoring to determine what has interfered with the normal process of development. Irregular habits, improper diet, malnutrition, caries, early loss of the deciduous teeth, prolonged retention of the deciduous teeth, delayed eruption of the permanent teeth, pathologic conditions of the tonsils and adenoids, all come in for consideration in the various types of malposition.

Such irregularities, introduced with the eruption of the permanent teeth, are not shown in the facial change until several or all of the permanent teeth have erupted. The dental arches being underdeveloped in many of these cases, it seems the permanent teeth erupt lingually, labially or buccally or almost anywhere in the line of least resistance.

Often, not enough concern is given the position of the permanent teeth and the possibilities that there will be sufficient space for those yet to erupt. The dental arches may not be easily recognized as being underdeveloped, and yet there may be little space for the erupting cuspids or bicuspids. The face, though not fully developed, seems normal in many instances as it is still carrying a few of the rounded features of the baby face.

But about the time the cuspids begin to make their appearance extremely high in the tissues and the lip is held out prominently by the erupting cuspids, the considerate mother becomes greatly alarmed and rushes her child to the dentist. Then, there are also those mothers who *hope* that Nature will care for the abnormality through development and that the teeth will erupt in normal position.

I might say in this connection that only in cases of normal development can we depend on Nature's developing space for the cuspids, or any of the

other permanent teeth, for that matter. If the combined widths, mesiodistally, of the deciduous cuspids and the first and second deciduous molars have been maintained, and the eruption of the incisors has been normal, we can feel quite sure that the eruption of the permanent cuspids and bicuspids will be normal. Frequently, the cuspids do apparently erupt into their normal position after first appearing in high labioversion, but it is usually at the expense of a malposition of a lateral incisor or one of the bicuspids. Many a lateral incisor is forced lingually or labially through the erupting process of a cuspid in malposition.

Following the eruption of all the permanent teeth up to and including the second permanent molars, we may expect, as before mentioned, that quite a change will soon appear in the face. The change at this age is more rapid, comparatively, than at any previous time. The dental structures, being the framework over which the face is built, are now responsible for the form of the face over a certain area.

It is at this time, if not earlier, that inharmony of the features, due to malposition of the teeth, is noticed by almost any observer. If the position of the teeth and the relation of the dental arches are abnormal, we may expect the features to be abnormal and to show more markedly as age advances. The dental arches being underdeveloped, with the teeth in malocclusion, there could not be normal function of the teeth. We could naturally expect a corresponding underdevelopment in the facial bones, because of the lack of stimulus, due to the absence of normal function. This would influence the face progressively toward the abnormal with age, until, at adult life, in many cases, the facial lines would be displeasing.

We shall readily deduct, then, that if we wish the face to develop normally through the influence of the stimulus of the teeth functioning in normal occlusion, the underdeveloped dental arches should be treated, as nearly as possible, according to the plan of Nature; which would mean, in my opinion, that treatment should be instituted so that the development in the dental arches would be sufficient to accommodate the teeth when they are ready to erupt, so that they would occupy their normal positions in the line of occlusion. Treatment should not be delayed to such an extent that the mechanical stimulus cannot properly prepare the dental arches in time for the eruption of the cuspids and bicuspids in their normal positions. By no means should we wait until all the teeth erupt before treatment is instituted. This means that as soon as it is observed that there is insufficient space for the erupting cuspids or bicuspids, orthodontic interference is necessary. This may be determined a year or more prior to the eruption of the teeth by roentgenographic examination.

When we have corrected the malposition of the teeth before this rapid change in the face takes place, the facial bones will build and grow under the stimulus of the normal functional adaptation of the teeth, and the overlying soft tissues will have a more pleasing appearance.

Much as we may speak of the benefits to be derived from having the teeth in normal occlusion and the effect on the oral and general health, their influence in molding the shape of the face should have its share of consideration.

We may be sure that the improve-

ment in the appearance of the child is the point that interests the parent as much, or more, than any other we may mention concerning the benefits of orthodontic treatment. The mother can see that something is wrong or out of balance as regards the features of the child, and it is this matter that she wishes taken care of.

In mentioning these benefits, the importance of normal occlusion is explained to the mother, its influence in the prevention of caries and in the prevention of the diseases of the supporting tissues, its advantage in the proper mastication of foods and its stimulus in the development of the dental arches and the nares through normal function.

Little stress is laid on the improved features in the facial lines that will result. It is usually taken for granted that the improvement in the facial lines will be satisfactory. But this is not always the case. If the case is treated during the incipient stages of malocclusion, this will be so, but if treatment is delayed, the improvement will not be all that it should be.

Comparatively few cases of malposition are brought to us primarily for the improvement of the health. The parent is seemingly not so much concerned about the child's general health. There is one thing that she is sure of, and that is that the child's appearance is not all that it should be. As in the case cited at the beginning of this paper, the parent has suddenly awakened to this fact. On examination of the mouth, she finds the teeth in malposition and very unsightly. A facial deformity has gradually grown until it is easily recognized. The intelligent parent today realizes the importance of a good appearance and she is unwilling to allow any preventable handicap to develop. She wants her child to grow to adult life prepared to meet every responsibility in the highest degree.

When the deformity becomes evident in the face, it does not matter whether the parents have purposely delayed treatment or not; whether they doubted the wisdom, or necessity of treatment; or whether or not the fee named suited them; when the cuspid makes its appearance in malposition, holding out the corners of the mouth or lips, as it does in many instances, they are sure they have waited long enough, and all doubt as to the advisability of treatment is removed.

Bringing the parent to this point is a slow process; but with the information that the dental profession has at this time, and its dissemination through their offices and through the educational system by lectures, and with the services and publicity of the school dental clinic in recognizing the deficiencies in the development of the dental arches and of the eruption of the teeth, we can look forward with much optimism to a time when fewer cases for delayed treatment will be seen. This advancement will be of inestimable value to the children of the coming generation.

The question of the proper age for orthodontic treatment will always be an interesting one. There are usually good reasons why a case should be treated during a certain period. In this discussion, we will eliminate all but the aesthetic reason—the facial appearance.

As regards facial growth, as influenced by the malposition of the teeth, I would emphasize as a chief principle that treatment should be instituted

prior to the beginning of any abnormality in the face.

In considering the age for treatment of the class of cases that make their advent with the eruption of the permanent teeth, and wherein the deciduous arches have been in normal relation or practically so, and the facial features harmonious, we cannot recognize in the facial lines the incipient stages of malocclusion. The dental profession, therefore, has quite a responsibility in observing the occlusion and the development of the dental arches. We are surely serving our patients with the highest degree of knowledge and judgment when we recognize the malocclusion before its influence on the facial lines is made manifest. We do not wish to be responsible for the beginning of a disfigurement. The incipient stages of malocclusion can be observed before their influence is noted on the facial features.

According to Nature's scheme of development and growth, there will be sufficient expansion of the dental arches for the normal eruption of the permanent teeth. With the eruption of the cuspids and the bicuspids in normal occlusion, Nature has fully completed the development of the dental arches, except in the posterior region.

Now, it would seem as reasonable that, in malocclusion and underdevelopment, artificial stimulus should be used at such a time to develop the dental arches on Nature's schedule, so that the permanent teeth will have sufficient space for their eruption and will erupt in normal position instead of in malposition, as when treatment is delayed.

All the teeth being in their normal relation at eruption, the fully expanded dental arches will be ready for this period of growth or rapid facial change soon to come. As the framework over which the facial structures will develop is in place, we can look for a well-balanced face. The facial bones and the cranium will be built according to the new arrangement of the teeth, and the face will probably be regular and harmonious.

When treatment is delayed until a later period, at which time this growth is practically completed, not only is the facial deformity quite pronounced, but even though we are able in many cases to obtain fairly successful results in treating the malocclusion and much of the deformity is corrected, Nature is never able to do justice to the case in building a face in proper proportions. The facial bones have been built according to the arrangement of the teeth in malposition, and it is, therefore, quite impossible for them to remold themselves completely, after treatment, to suit the new arrangement. As a result, more or less disharmony prevails.

In the planning of any structure, all the details are laid out in the architect's designs, and we find it quite impossible to alter them in any degree after the construction is under way. If we decide on an extra floor or an added room, that must be considered in the laying of the foundation.

In early child life, the plan of the face is laid in the dental arches in the form of the crowns of the teeth. In many instances, these plans have been greatly interfered with through change in environment and from other causes, some of which have already been mentioned, until the face has grown and developed abnormally.

The earlier the teeth are recognized as being misplaced, and the earlier they

are placed as it was intended they should be placed, the more nearly will the development and growth go on normally.

The dental arches should be fully developed by the time the cuspids and the bicuspids erupt. Would it not seem perfectly natural and reasonable that they should be artificially established by that time? The facial bones and the soft tissues will then develop harmoniously, and we can reasonably expect the features will be presentable. The patient, for the remainder of her days, will thank dentistry for recognizing the abnormal at its incipiency so that treatment could be instituted early enough to be effective.

DISCUSSION

T. G. Duckworth, San Antonio, Texas: Following the eruption of the teeth from the sixth month to the twelfth year, with the completion of the permanent dentition, you can notice the marked development taking place throughout the whole face. It is interesting to watch the teeth and note the improvement that is made as the succeeding teeth erupt, and I believe you will find the first permanent molars and cuspids are generally more nearly in normal position than any of the other teeth, considering their size and the position they occupy in the arch.

George B. Crozat, New Orleans, La.: If such papers as this could reach the general practitioner, inestimable good would come to their patients and to ours. The object of early treatment of malocclusions is apparent to all of us. Many cases of facial deformity in maturity would be prevented if apparently insignificant malocclusions were recognized at an early age, and properly diagnosed and treated. Unfortunately, treatment is too frequently delayed. The ideal results cannot be attained at such time, and retention is made most difficult. Early treatment should be our watchword. We should, whenever the opportunity presents itself, encourage our confréres to recognize and treat malocclusions early.

B. Frank Gray, San Francisco, Calif.: Dr. Flesher's paper has brought to mind a matter about which I have often thought and about which little has been said or written. It is true, as he states, that the parents often come to the orthodontist, not so much because they fear the results of a lack of function that goes with malocclusion, but because they are distressed by the obvious disarrangement of the child's teeth. They do fear facial and dental deformity, in whatever degree. So I should like to emphasize the fact that parents desire comeliness and perfection in the child, even during its developmental years, which is a most worthy thing. Certainly if we are able, in gratifying the parents' vanity, at the same time to do a service of permanent value to the child, our efforts will not have been expended in vain. The idea of allowing serious inharmonies to exist over long periods of time, awaiting a "proper time" for their correction, is discredited very often by such considerations as I have noted.

T. O. Gorman, San Antonio, Texas: Orthodontic cases present themselves to us not on account of inability of the child to masticate foods, but because the parents have recognized something in the child's appearance that they do not like. We have been talking a great deal about preventive dentistry and preventive medicine. I do not think there is any specialty in either branch in which the members are so helpless as we are in preventive orthodontia, for the reason that, in nine out of ten cases, we see the patient only after marked irregularity has developed. We have no opportunity to prevent irregularity, and, it seems to me, general practitioners take practically no interest in the development of the dental arches. Their interest seems to be confined to the placing of fillings and the extraction of teeth. If we could get hold of many of these cases at the proper time, the irregularity might be corrected with a little work, and a serious deformity be prevented that might otherwise involve much additional difficult work later on; but we are absolutely helpless in preventive orthodontia.

A CONSIDERATION OF THE FACTORS GOVERNING SUCCESSFUL ROOT-CANAL OPERATIONS; CAUSES OF PERIAPICAL INFECTION

By CARL J. GROVE, Ph.G., D.D.S., F.A.C.D., St. Paul, Minnesota

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

THE profession has, in my opinion, adopted a too radical attitude toward pulpless teeth in classing all as infectious. Periapical infection does not necessarily occur because the pulp is removed from a tooth. In fact, the mere absence of the pulp is never the cause of such infections. I believe this erroneous conception is due largely to lack of proper understanding of the etiology of periapical infection.

The variance of opinion regarding the cause for these infections may be due, partly at least, to failure to take into consideration the fact that the character of the tissue in the extreme root end is not pulp tissue, as has been so generally believed.

To quote from an article published in July, 1916:[1]

> What shall be done with these tissues when the pulp tissue is devitalized?
>
> The general supposition is that the pulp tissue passes through the apex into the periodontal membrane in fully developed teeth.
>
> It should be remembered that the apical foramen of fully developed teeth is formed by the cementum. If the pulp tissue were present in this portion of the canal, dentin should be formed by the odontoblasts in the pulp tissue. I believe the fact that this does not occur clearly indicates the erroneous character of the theory that the pulp extends through the foramen.

This tissue which is periodontal membrane is placed in the root end of the canal for the purpose of making possible the prevention of periapical infections in pulp removal. Every effort should be made to preserve this tissue if successful root-canal operations are desired. In my opinion, the cause for these infections is the destruction of the tissue, whether it be by the use of medicaments or by mechanical means, and *not* the removal of the pulp.

The present methods of root-canal operations are sufficiently faulty to produce infections in more than 75 per cent of pulpless teeth. The practice of opening the root canals to the apex by the use of decalcifying agents and the use of other irritating remedies in the root canal is responsible for much of the infection existing at the present time.

In the preservation of this tissue, at least 75 per cent of pulpless teeth will be free from infection directly reverse to the present situation.

We are often prone to regard the loss of a tooth too lightly, and the mere evidence that a tooth is pulpless is considered sufficient reason for extraction. The contributions to our literature favoring this practice have indeed been too frequent. It will only be through a general disapproval of this attitude, with a full realization of the evil effect resulting therefrom, that we can hope to cope with the situation.

1. Grove, C. J.: Dent. Cosmos, July, 1916.

To appreciate the importance of the retention of noninfected pulpless teeth, one must fully realize the value of their service as well as the harm resulting to the entire arch from the extraction of even a single tooth. The total disregard of the importance of all pulpless teeth by many recent graduates is appalling.

Because some investigators have discovered streptococci at the apex of a large percentage of pulpless teeth, the extraction of all pulpless teeth has become common practice. This teaching is based upon bacteriologic findings only. Whenever diagnosis is based upon one branch of science only, error is likely to creep in.

If the pulpless teeth that are extracted are sectioned and examined under the microscope, it will be found that evidence of infection is lacking in many. It should be remembered then wherever infection exists, bacteria are active; they are not merely lying dormant in the tissue. During the various stages of infection, there is a continual process of tissue destruction. The result of such disturbance can always be recognized in sectioned tissue by means of the microscope. If no cell destruction is revealed and no histologic change from the normal investing tissue is present, infection does not exist. More positive proof that such teeth are not infected could be offered.

I am not offering an argument for the retention of infected pulpless teeth. I believe all such teeth should be extracted. The point I wish to emphasize is that not all pulpless teeth are infected. Some maintain that whenever the pulp is removed, the irritation thus produced causes the resistance of the periapical tissue to be lowered to such an extent that infection is induced. That infection will occur when undue irritation is produced in pulp canal surgery cannot be denied, but this can be avoided in all cases of pulp removal.

As I have frequently shown by photomicrographs of sectioned root end tissue, the foramen is divergent with periodontal membrane folding into this divergent space. The apical portion of the pulp tissue unites with this membrane. The pulp does not extend through the foramen as has been taught, but ends a short distance from the opening. The narrowest part of the canal is at the point where the pulp unites with the membrane. If a barbed broach is inserted to about this point, the pulp will invariably separate at its union to the membrane. Frequently, an attempt is made to remove the tissue in the foramen, in the belief that this is pulp tissue. This will result in serious irritation, and frequently infection will immediately follow the destruction of this tissue. Experiments that I have conducted on dogs showed that infection invariably followed the destruction of this tissue.

It should be remembered that the foramen of all teeth in advanced age or middle life is made up of cementum and not dentin. The fact that cementum forms the foramen makes it obvious that periodontal membrane once existed in this area and that the membrane has been transformed into cementum. The tissue in this part of the root canals in teeth of youth is periodontal membrane. It is important that this fact be borne in in mind when removing the pulps of such teeth.

The blood vessels extending into the pulp pass through the membrane. When all the vessels pass into the pulp from a position directly opposite the opening, only one canal is formed, but when the vessels pass through the foramen from different angles several canals are formed. In the process of obliteration of the membrane and the deposition of

cementum, the blood vessels are not obliterated, but are left intact; cementum is laid down around the blood vessels, leaving an opening for each vessel; and thus we have multi-canals.

In the removal of the pulp, no concern need be felt regarding the tissue in the multi-canals, for, as I have already stated, blood vessels occupy these canals. After the pulp is removed, these vessels are obliterated, having served their function. A deposit of cementum is laid down in the foramen of each canal. The periodontal membrane folds into the apical openings of these canals just as it does in the opening of the larger canals. An attempt to open these canals by the use of chemical agents of any character will result in the destruction of the membrane, followed by infection.

The most important factor in the success of this operation is absolute asepsis. All instruments, as well as all material introduced into the root canal, must be sterile.

There are, however, other matters of great importance, such as the avoidance of undue irritation to the tissue. Undue pressure must be avoided when the filling is placed in the root canal. The force ordinarily used in filling root canals by the method now in vogue is greater than is required or is safe in this operation. Pressure will cause atrophy of these tissues, with infection following.

I wish especially to emphasize the danger of employing medicaments of any nature in root canals from which the pulp has been removed. It has become a habit with many dentists to use powerful disinfectant agents to assure sterilization of the root canal. If strict asepsis is observed in the removal of the pulp, agents of this character are not required.

Immediate root filling should be done. Some may object to this because absolute dryness cannot always be obtained at this sitting. A slight exudate is of no serious consequence. I do not mean that canals should be filled when the flow of blood is perceptible, but when the cotton points show only a coloring of blood, I do not hesitate to fill the canal. Hemorrhage can invariably be controlled by packing the canals firmly for a few minutes with sterile cotton points.

There are, of course, always some exceptions to the rule of immediate root filling, but they are extremely few. In these cases, when a dressing is required, I would suggest that a mild antiseptic be used. The root filling material must be free from irritating as well as destructive properties.

I must emphasize the importance of removing all of the pulp tissue. Great care must be exercised to avoid undue injury to the tissue in the foramen. As I have already stated, the narrowest part of the pulp is at its union to the membrane. The pulp will naturally separate from the membrane at this place as it is the narrowest and weakest point. If, in this operation, only fragments of pulp tissue should remain, they may be changed to scar tissue, which has a very decided resistance to infection, Nature producing this change of tissue to prevent periapical infection. Investigations lead me to believe that this fibrous tissue remains as such throughout the life of the tooth. When all of the pulp tissue is removed, a transformation of the membrane in the foramen takes place, cementum forming to close the foramen, but I do not believe this ever occurs where pulp tissue is left.

Experiments conducted on dogs' teeth showed that when parts of pulp tissue

were left, infection occurred in a high percentage of cases.

As stated, chemicals of any character should never be used for removing pulp tissue, for such agents will destroy the tissue in the foramen, periapical infection resulting.

Only teeth with vital tissue in the foramen are free from infection. I base this statement upon the fact that all the noninfected pulpless teeth that I have sectioned and examined microscopically have had either vital fibrous tissue or cementum in the foramen. Such teeth have not, of course, been filled to the very end of the root. It is upon these findings that I base the statement that a greater percentage of rarefied areas exists at the apex of roots that are termed "perfectly filled" than is found at the apex of roots that are fairly well filled.

CONCLUSION

When no evidence of periapical infection is disclosed by a roentgenogram that shows clearly the details of the investing tissue, an electric vitality test should be made. It would be found that all pulpless teeth having vital tissue in the foramen, either cementum or fibrous tissue, respond to this test. As I have already stated, teeth having vital tissue in the foramen have been found to be free from infection by microscopic examination. It is therefore my contention that all pulpless teeth responding to this test are free from periapical infection. It will also be found that infected teeth do not respond to this test. Roentgenographic findings can then be checked and it can thus be determined whether or not infection is present.

I employ a tester that allows both the negative and positive poles to be applied to the tooth under examination, which obviates isolating the tooth to be tested as there is no radiation outside of the two platinum electrodes.

SUMMARY

1. The tissue in the root end of the canal is periodontal membrane, not pulp tissue, and should be preserved. The membrane will be transformed into cementum, filling this part of the canal, or fibrous tissue will be formed, remaining as such throughout the life of the tooth.

2. The mere destruction and removal of the pulp tissue is never the cause of periapical infection.

3. The destruction of the membrane in the foramen, whether by chemical or mechanical means, is the cause of periapical infection.

4. Only teeth with vital tissue in the root end of the canals are free from infection and, in the presence of infection, this tissue will not remain vital.

5. Infection invariably follows when part of the pulp tissue is left.

6. Teeth responding to the electric vitality test are not infected, as infected teeth will not respond to this test.

THE LIMITATIONS OF THE ROENTGEN RAY IN DENTAL PRACTICE

By C. EDMUND KELLS, D.D.S., New Orleans, Louisiana

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

Faith is the substance of things hoped for, the evidence of things unseen.

MANY roentgen-ray operators have such blind faith in their art that they interpret their films upon the "evidence of things unseen."

As it appears to me, dentistry has today reached the zero hour in many things, and one of these is the roentgen ray. This may appear strange on the face of it, but I believe that, on serious thought, it will be seen that this is the case.

The principal trouble today is not with the roentgen ray itself, nor the actual *things* used in its production and recording. We are furnished most effective generators of the ray. We are furnished most satisfactory films, on which to make records, and many operators obtain rather satisfactory roentgenograms.

Such being the case, why are we at the zero hour? The zero hour is marked by the interpreters of the roentgen ray, and therein lies the trouble.

It is the easiest thing in the world for an enthusiastic specialist to be carried away with his work, and so great becomes his faith in it, and in himself, that his usual clear vision becomes obscured and he believes that he can accomplish what to others, whose vision is not clouded, is known to be impossible. And so it is that some of our most expert radiodontists are innocently led to believe that the roentgen ray can and should be used in cases in which the more conservative operator realizes that it is of absolutely no value. The object of this paper then, is to bring before you some of these fallacies and to tell you, as far as my experience has shown, what *cannot* be learned by the ray.

To begin with, we must bear in mind that all objects that are not radioparent cast their shadows on the film, and these recorded shadows, or possibly, should one want to split hairs, I should say a series of superimposed shadows, are all that can be seen on the film and are all that we have to study.

FALLACIES

1. Radiodontists are continually referring to the relative position of a filling to the pulp, *as shown by the film*. "Filling endangering the pulp" is frequently seen in these reports.

Let us assume a case: a molar containing a vital pulp and a small metallic filling on its buccal surface. The roentgenogram shows the outlines of the tooth, the pulp and the filling, but no living man can tell by such a picture whether the filling is on the buccal or lingual surface, nor how near to the pulp is this filling.

I once presented such a film to a number of radiodontists at a meeting, and I defied anyone to determine whether the filling was on the buccal or lingual surface of the molar. At first no one ventured an opinion, but finally an "expert" studied the picture carefully and said, "On the lingual." The tooth was then produced. It was a perfectly sound tooth. I had drilled a small hole down through the center of the crown, enlarged it a little at the bottom and filled the enlarged part with amalgam. Thus it was that the filling was on neither the buccal nor the lingual surface, but exactly in the center of the tooth.

Thus, the statement that the relative positions that fillings bear to pulp chambers can be shown on the film is a fallacy.

2. Not so long since, a radiodontist gave as one of the requirements of a roentgenogram that it should reveal the lamina dura entirely around the roots, a requirement that no roentgenogram can meet. The lamina dura encircles the root, and so only on the profile of the root can it leave its imprint on the film, because the shadow of the root itself effaces all the rest.

Under these circumstances, there may be a pyorrheal abscess on a root that has entirely destroyed a comparatively large section of the lamina dura, and yet, because of the location, the condition cannot be shown upon a film, which demonstrates the fact that it is impossible for anyone to look at a film and learn whether or not the lamina dura of the tooth shown is in good condition, and proves that the *requirement* of the radiodontist in question is just a fallacy and nothing more.

3. Radiodontic enthusiasts acclaim the value of the ray for disclosing cavities of decay. All I need to say to this is to repeat what I have often said before. Every cavity of decay on any tooth is open to discovery by means of the explorer and the mouth mirror. Any dentist who cannot find such cavities needs a competent assistant to make his examinations for him, and not a roentgen-ray machine.

This claim is not only a fallacy, but an absurdity as well. Where is the intelligent person who would continue, year after year, to go to any dentist who would subject him to the expense of a full (?) set of films every few months, or once or twice a year, for the purpose of finding cavities, when he could go to some other dentist and have these cavities discovered by a simple examination? Our patients, *as a rule*, are not devoid of common sense.

Superficial decay on proximal surfaces of teeth in contact with each other will invariably look suspicious to the trained eye, whereupon the teeth should be separated and this superficial defect polished off. It would be simply impossible for such superficial decay to show on a film. And more than that: Many cavities of decay,

easily seen or located with an explorer, never could, owing to their positions, be shown on a film.

I would be only too glad to embed some natural teeth in a block of paraffin and let any radiodontist who will examine them by roentgen ray and describe the cavities and incipient decay.

In this connection, several pertinent questions immediately come to mind:

(*a*) Who is to make this periodic roentgen-ray examination for cavities, the radiodontist or the dentist?

(*b*) How many films will be required for the examination?

(*c*) How often must this examination be made?

(*d*) What will be the charge for the set of films?

Many dentists prefer not to be deadheads, and, therefore, pay for their own dental services.

How many of these men would select for their dentists those who would send them to a radiodontist for periodic roentgen-ray examinations for discovering cavities? Would they not be more likely to select dentists who examine their teeth in the good old fashioned way?

And still another point: A man, especially a teacher, should be consistent. Do radiodontists, themselves, undergo this periodic roentgen-ray examination for the purpose of discovering caries in their own mouths? How many of them do, I wonder.

4. Again we are told that the ray is valuable for the discovery of overhanging fillings. This is another absurdity. Fillings on the lingual and buccal surfaces of the teeth, when they extend below the gum line, are prone to have overhanging edges, deep down under the gum.

Such overhangings can be readily discovered by an explorer, but could overhang until doomsday and never give any evidence on the film of such being the case. On the proximal cervical margins, yes. Anywhere else, absolutely no. Just another fallacy.

5. To believe, for a moment, that the roentgen ray will invariably show the number of roots a tooth may have and the courses of their canals is another woful fallacy. Sometimes that may be true, but many times it is not.

Once upon a time, I tried in vain to find and fill the root canal of an upper second cuspid. Finally, I gave it up and extracted the tooth. Imagine my surprise to find it had three roots and three root canals. On reporting this case, I was taken to task by an expert radiodontist who said that the three roots should have been shown on my films. In other words, I had made a failure with my roentgenograms.

I set a number of teeth, including this three rooted bicuspid, in a row, embedded them in paraffin and covered them all with a thin layer of plaster of Paris, and sent the block to him to film and locate the three rooted bicuspid. He roentgenographed the block and noted his readings. The tooth he diagnosed as the three rooted bicuspid was not it. I have not heard from him since about this picture. The roentgen ray cannot accomplish the impossible.

6. Infection: It is a common occurrence to hear a man say that a film shows an abscess on some tooth. No

abscess, no infection, leaves any imprint on a film by which it can be definitely recognized.

The correct interpretation of such a film would read somewhat like this:

Here is undoubtedly the outline of a lower molar tooth, and the outlines of the pulp chamber and root canals (or, rather, some of its root canals). The outline of some filling can be seen, but whether it is of metal or not, cannot be recognized. Here are the signs of the lamina dura and the periodontal membrane. Right here, at the ends of the roots, these two elements are missing and a radiolucent area extends around the root ends.

The radiolucent area means nothing more or less than that decalcification of that area has occurred, and it means absolutely nothing else.

It may be infected; it may not be infected. The appearance of the film at this spot would be exactly the same whether the spot were infected or sterile. No one can truthfully deny that statement.

This decalcified spot is undoubtedly an evidence that infection was there at one time, but no one can say whether or not the area has become sterile or remained infected.

That would be the correct interpretation of such a film, as I take it.

A fire occurs, a building burns to the ground, nothing is left but a pile of wreckage. A month later, the wreckage is still there. Are these ashes "evidence of fire"? They certainly are not. Poke around among them and you will find no evidence of fire, but everything about is evidence that once upon a time, maybe yesterday, maybe six months ago, there was a fire here.

No evidence of infection can be shown on a film.

Fallacy number six—the greatest fallacy of all—that infection can be disclosed by a film.

7. Many, if not most, radiodontists claim that roentgen-ray examinations should be made for all new patients. I have heard that statement made and have read it many a time. Roentgen-ray examinations have been needed by comparatively few new patients in my practice. Such a thing as requiring a complete roentgen-ray survey of all new patients is not only absurd: it borders on something more serious. A man should be consistent. None of my family has ever had a complete roentgenographic survey, because not one of us has ever needed it. There is not a pulpless tooth in the whole family. Just as these "radiodontic surveys" or roentgenographic routine examinations have never been needed by any one of the three generations in my family, so they are not needed by hundreds of my patients, and, therefore, they are not given them.

Fallacy number seven, that all new patients should have complete radiodontic surveys.

CONCLUSION

I do not believe that anyone can show a record more consistent, in the advocacy of the use of the roentgen ray in dental practice, than mine has been; nor can anyone show a record so long. Consequently, in view of these facts, I do not believe that, at this late day, I can be understood to minimize its value just because I insist that it has its limitations.

DISCUSSION

Clarence O. Simpson, St. Louis, Mo.: Dr. Kells is right in cautioning against overenthusiasm, and in protesting the deductions that are sometimes made from roentgenographic negatives, but he was unfortunate in the selection of his examples. Quite generally a positive diagnosis is made from

roentgenographic records that are technically so imperfect that the evidence is unreliable. Men of limited experience see fantastic things when interpreting roentgenographic evidence. The cycle of error is usually self-sustaining. One of limited experience is satisfied with inferior roentgenography, and is positive in his conclusions. One who is positive in his conclusions is limited in experience and satisfied with inferior roentgenography. One who is satisfied with inferior roentgenography is positive in his conclusions and limited in experience. Examples of this incompetence are common, and had Dr. Kells been content to discuss them, he would have had abundant material and an instructive contribution. The contentions enumerated will be briefly analyzed. 1. Can the relations of a filling and the pulp be determined from the film? There are two methods by which this can be determined, an occlusal view and a stereoscopic view. From the customary lingual view, such deductions should not be made without inspection of the tooth. Competent radiodontists make a clinical examination before deciding questions of this nature. 2. Should a roentgenographic examination reveal the lamina dura entirely around the roots? Since I am the author of the statement to which Dr. Kells objects, his correction is accepted. Too much was left to the conception of the reader to conform to the requirements of a legal document. However, in a test of the limitations, it will be found that all the surfaces of unobstructed roots can be revealed roentgenographically except a comparatively small area on the lingual and facial surfaces; and that a large area of destruction would be disclosed. 3. Are roentgenographic examinations indicated to disclose caries? The value of roentgenographic examinations to disclose proximal caries should be obvious to an unprejudiced investigator. I have urged this application of roentgenography for the conservation of teeth. In contrast to the trained eye, to which invisible "superficial decay invariably looks suspicious," it is almost a daily occurrence in a radiodontic practice to find proximal decay that has not been discovered in a recent clinical examination. Dr. Kells has told me that he searches for proximal caries by having the patient insert a rubber wedge between the teeth at night and return for examination the following morning. A consideration of the time, discomfort, and possibilities for injury incurred by this method as compared with a roentgenographic examination of the region, answers the question. The direct questions are referred to Dr. Raper, who has some new ideas on this problem. 4. Can overhanging fillings be discovered by roentgenographic examinations? Excess filling material at the cervical margins of proximal restorations can be discovered more easily and with more precision by roentgenographic examination than by any other method. No one advocates this application of roentgenography for other than proximal surfaces. Most restorations with cervical margins are on the proximal surfaces, and the cervical margins of proximal restorations are difficult to examine, while those on other surfaces are readily explored. 5. Can the number of roots on a tooth be determined by roentgenographic examination? The number of roots should be disclosed by a thorough examination unless they are fused or in apposition. 6. Can the evidence of infection be shown by a roentgenographic examination? Roentgenographic records show evidence of infectious processes, but not proof of the existence of infection. Demonstrating the presence of pathogenic organisms does not prove the existence of infection, or even show evidence of infectious processes. Roentgenographic evidence is dependable in demonstrating chronic infectious processes and subsequent repair in bone. In combination with corroborative factors, the roentgenographic demonstration of infectious processes in alveolar regions may be accepted as evidence of infection, with a negligible percentage of error, and in accuracy favorably compares with other diagnostic methods. Sound judgment is essential in diagnosis, but conservatism in expression should not be carried to the point where verbal qualification and nullification evades a conclusion. 7. Is a general radiodontic examination indicated for all new patients? Periodic radiodontic examinations are individually indicated to a degree proportionate to the amount of reparative dentistry and the susceptibility to dental disorders. Since most new patients have had dental repairs, and the susceptibility of the others cannot be excluded, a general radiodontic examination

will give the operator information and a record that should not be ignored. Unless Dr. Kells opposes an ocular inspection and an instrumental examination of new patients, he should carry the examination to the logical conclusion of investigating the regions that are inaccessible and invisible. Few operative procedures are productive of uniform results in application, but the proportion of adult patients in which a general radiodontic examination reveals nothing of clinical importance is too insignificant to condemn the practice. No one can prove whether or not a radiodontic examination is indicated until it has been performed, and negative findings have not disproved the value of periodic examinations for preventive service in other branches of medical practice.

Howard R. Raper, Albuquerque, N. M.: (Dr. Raper's discussion of Dr. Kells' paper is incorporated in an article on page 1084.)

C. N. Johnson, Chicago, Ill.: Dr. Kells was the first man to adopt and use the roentgen ray in dental practice. His contention with reference to the enthusiasm of the specialist who is constantly "seeing things" is well taken at this time when there is so much lack of balance in many of our professional procedures. We need specialists but we do not need certain brands of the enthusiasm they display. For instance, when they become so enthusiastic as to hold a film up to the light and say that a certain tooth has an abscess at the apex, or that it is infected, or that it has a pus sack, or when they write these things on diagnostic charts and hand them to the patient, they are permitting their enthusiasm to run away with their good judgment. And incidentally they are sometimes doing incalculable harm to the patient. It should be emphasized in every possible way that no man can tell by a roentgenogram whether or not there is infection around the apex of a tooth, and recognizing this fact, the better element of our radiodontists have long since ceased to write these terms on their charts. Men like Dr. Kells, Dr. Simpson, and Dr. Raper have done their utmost to stabilize the science of radiodontia and make it serviceable to dentistry, instead of harmful. Dr. Raper, in one of his books on this subject, pointed out in detail the various errors into which we might fall through imperfect interpretation, and if the profession generally would read what these men have said, and study their methods, we would soon have a saner point of view on the entire roentgen-ray question. The better men who are practicing radiodontia are using every effort to overcome the evil influences that have crept into it, and today the chief harm is being done by men who are pseudoradiodontists, and not by men of the type represented here today. It has been my experience that some of the radiodontists who do this work in the various hospitals are sadly at fault in their interpretation of evidence around the teeth. Not only that, but the technic of their work is frequently very defective. And yet with this imperfect manner of utilizing the roentgen ray they are constantly writing on their reports such terms as "abscess" and "infection," and handing them to the patient to read. Again and again, I have proclaimed against the evil of radiodontists writing these terrifying terms and permitting the patient to see them. The aggregate of harm done to people through this agency can never be atoned for in this generation. People by the hundreds without the slightest tangible pathologic affection have been frightened almost into mental anguish by being told that they have abscesses, infections, or pus sacks concealed in their jaws. As Dr. Kells has said, no roentgenogram is capable of demonstrating these things, and the sooner we recognize this fact, the better it will be for our patients. The roentgen ray has sufficient value within its proper sphere to entitle it to our consideration, respect and gratitude, without heaping on it the incubus of a reputation for infallibility which, in the wildest imagination of its enthusiasts, it is never able to sustain. Papers like that of Dr. Kells will tend to stabilize roentgen-ray evidence and make it serviceable and exceedingly valuable and will minimize the false estimate that heretofore has been placed on it.

Dr. Kells (closing): As a rule, society papers are made up of statements of certain facts and opinions. My paper is no exception to this rule. Those interested can read the paper and its discussion and draw their own conclusions as to whether or not I am correct in the various facts and opinions offered.

PRACTICAL CLINICAL PREVENTIVE DENTISTRY BASED UPON PERIODIC ROENTGEN-RAY EXAMINATIONS*

By HOWARD R. RAPER, D.D.S., F.A.C.D., Albuquerque, New Mexico

I

FIRST of all, let me make it clear that the interproximal roentgen-ray examination herein advocated and briefly described is not intended to take the place of the well-known periapical examination now in wide use. It is something different, used for a different purpose. Its main purpose is to prevent the occurrence of pulpless teeth, while the main purpose of the ordinary dental roentgen-ray examination is to observe them after they have developed. If a patient needs a general root-end examination, this new interproximal examination cannot be substituted. On the other hand, a great majority of people need the interproximal examination, but do not need the general root-end roentgen-ray examination. It is no exaggeration to say that everyone who wants to save his teeth, at the minimum cost and the maximum of safety to health, needs the interproximal roentgen-ray examination periodically. The root-end examination is indicated only for pulpless teeth, teeth badly affected with pyorrhea and impacted teeth, and in cases of systemic disease suspected to be of dental origin and special cases of neuralgia.

*A reply to Dr. Kells' paper, "The Limitations of the Roentgen-Ray in Dental Practice," given, in substance, in a discussion presented before the American Dental Association, Dallas, Texas, November 10-14, 1924.

II

At the 1923 session of the American Dental Association, Dr. C. O. Simpson read a paper before the Section on Operative Dentistry and I, with Dr. Kells, discussed it. Both Dr. Simpson and I expressed the belief that the time was coming very shortly when people would have periodic roentgen-ray examinations of the teeth to disclose incipient caries (and other interproximal findings). I do not presume to speak for Dr. Simpson, but, for my part, I intended that my statement should sound mysterious—or foolish. Dr. Kells evidently did not hesitate in his judgment; he considered it foolish. I venture the deduction that it supplied at least a part of the inspiration for his comment that "It is the easiest thing in the world for an enthusiastic specialist to get carried away with his work, and so great becomes his faith in it, and in himself, that his usual clear vision becomes obscured and he believes that he can accomplish what to others, whose vision is not clouded, is known to be impossible." And it seems to have stimulated him to most of what he has written under fallacy number three.

But Dr. Kells did not know, at that time, of the new interproximal roentgen-ray examination, and I did; so what sounded foolish to him I knew was not foolish.

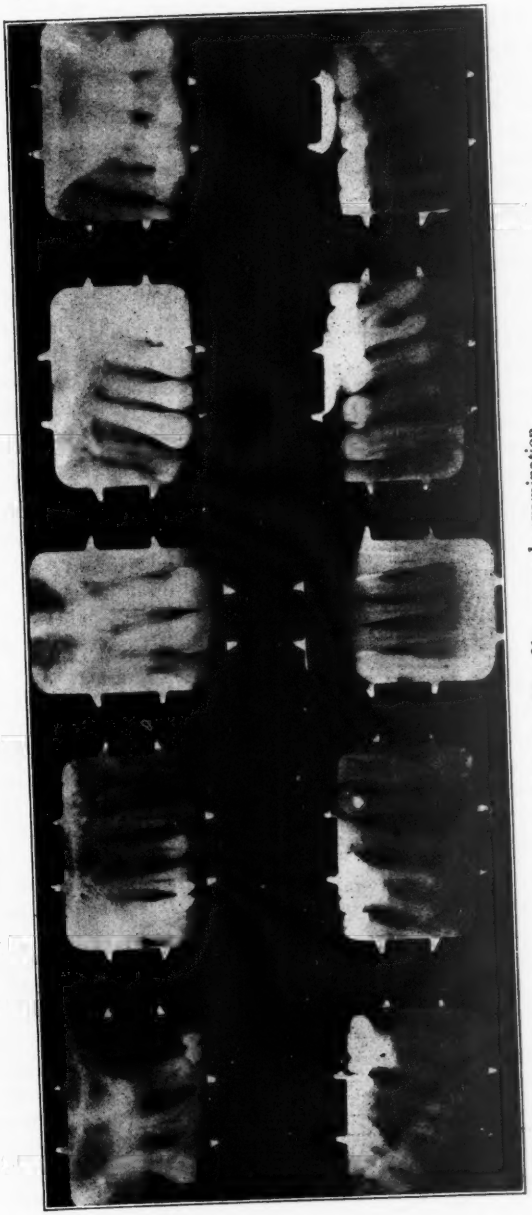

Fig. 1.—Ten-film general examination.

Dr. Kells asks four specific questions. Allow me to answer them—twice: first, as I believe Dr. Kells thinks I would have to answer them if truthful; and again, as I find it possible to answer them in view of the fact that we now have at our disposal a new systematized method of roentgen-ray interproximal examination that makes periodic roentgen-ray examination feasible.

Dr. Kells asks: "Who is to make this periodic roentgen-ray examination for the discovery of cavities—the radiodontist or the dentist?" Dr. Kells expects me to answer that by saying: "The radiodontist of course, and preferably the radiodontist who signs my personal checks, if you know what I mean."

"How many films will be required for the examination?" When he first asked this question, Dr. Kells expected me to have to answer by saying: "Ten or fourteen." Perhaps he expected me to go further and explain that the ten-film examination is not very good, that the angles are not right to see between the teeth, and that therefore we should use fourteen. Such an answer he knows would prove the impracticability of making periodic roentgen-ray examinations for the discovery of incipient caries (and pyorrhea).

Third: "How often must this roentgen-ray examination be made?" Dr. Kells tells, himself, how he expects me to answer that by talking about making it "every few months or once or twice a year." So he answers the third question, to his satisfaction, for me.

Fourth: "What will be the charge for a set of films?" He expects me to have to say: "Not less than $10 and from $10 up to, say, $30 or more."

III

Now let me answer the questions as it is possible to answer them in view of the fact that I have developed a new method of making a roentgen-ray interproximal examination.

First, "Who is to make this periodic roentgen-ray examination for the discovery of cavities—the radiodontist or the dentist?" Either one, either the dentist or radiodontist; it doesn't make any particular difference which. Some of each are competent, some incompetent. It doesn't have to be a specialist by any manner of means. On the other hand, a dentist need not do his own roentgen-ray work unless he wants to. He can refer it to a specialist, and be within the law.

"How may films will be required for the examination?" Only one-half the usual number; that is to say, either five or seven, not ten or fourteen. (Fig. 3.)

"How often must this examination be made?" Every year, I should say, or every two years, depending very much on the case. During early life, I should say every year for the average case. After 30, every eighteen months or two years unless there are some particular lesions the operator wishes to keep under more frequent observation.

"What will be the charge for a set of (five or seven) films?" I cannot attempt to tell men exactly what they should charge, but I can say this: an ordinary five-film examination can be made, at a reasonable profit, for $5—and I should like to connect the idea of $5 with this examination.

To name any fee is, of course, to mention the average or minimum fee. Men who do extraordinary work, or

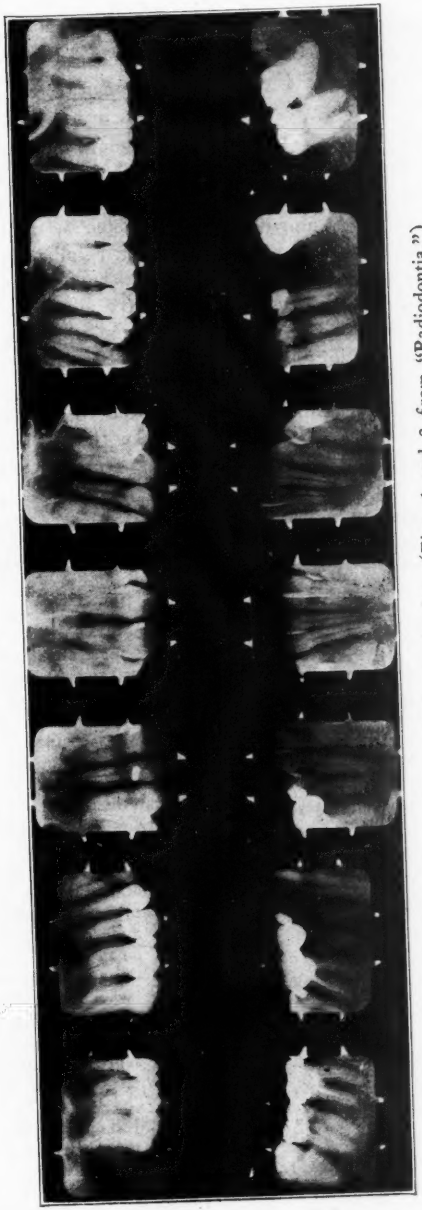

Fig. 2.—Fourteen-film general examination. (Figs. 1 and 2 from "Radiodontia.")

work under extraordinary conditions, must receive extraordinary fees. My friend Simpson thinks the fee I mention a little low; and so it is, for him. He is constitutionally incapable of doing a thing in an average or ordinary way. He insists on perfection, and so he multiplies his problems and difficulties, both economic and otherwise, as artists and superior men always have and always will. But for the sake of the people, our patients, and keeping my mind on moderate averages and off superlatives, I name a fee that is economically sound for both dentist and patient. I have recently had a letter from Dr. A. C. Fones in which he urges that the fee for the examination be kept at "the minimum in order to make it available frequently to people with modest incomes." With this general sentiment and principle, I heartily agree. At the fee named, the patient with the "modest income" can afford the periodic interproximal roentgen-ray examination. Indeed, he can afford "nothing else but" (to express it in the parlance of the hour). He will save time, money, health, teeth and trouble by subscribing to the policy of prevention for which this periodic interproximal roentgen-ray examination stands.

IV

Before I proceed to a further discussion of Dr. Kells' paper, allow me to discuss the pulpless tooth problem; for this interproximal roentgen-ray examination is intimately related to the pulpless tooth problem. It is, indeed, I honestly believe, the solution to the pulpless tooth problem, and the pulpless tooth problem is the one genuinely big problem dentistry has to face today. Compared to it, all our other problems shrink into comparative insignificance.

"The next great step in medical progress in the line of preventive medicine should be made by the dentists. The question is, will they do it?" No statement ever uttered by a man has been quoted by dentists so many times. Dr. Mayo said it in 1913. I contend that we have not yet taken the step. We have done much, but I believe that it can never be said that we have taken the step referred to by Dr. Mayo until we become more active in the prevention of pulpless teeth.

I take the liberty, at this point, of quoting from an article of mine published recently:[1]

> I ask you, for the moment, to consider death and disease in a broad general way. When a man dies of disease (or old age) he does not die all over, all at once, click, just like that. He dies in pieces. Before his, I might say, final death, he is already dead and undergoing disintegration in parts (in the various organs) of his body. A very old or very sick person is already partly dead, while the remainder of the organism awaits its turn.
>
> Perhaps the most common and most noteworthy characteristic of disease is tissue death and destruction. Tuberculosis attacks and destroys the lungs; syphilis attacks the shin bone, the palate, the spinal cord; smallpox attacks the skin; gastric ulcer, the lining membrane of the stomach; destructive tissue change occurs wherever there is suppuration and, to a lesser degree, wherever there is inflammation; and so on. When we find albumin, casts, cells and blood in the urine, what does it indicate? Nephritis. Yes, but nephritis is only a name. The important thing about such urinary findings is that they represent destructive tissue changes in that vital organ of the body called the kidney. The loss of body weight, so common to all disease, is but another manifestation of the fundamental fact that disease spells tissue destruction.

1. Raper, H. R.: Internat. J. Orthodontia, 11: 76 (Jan.) 1925.

The disease, dental caries, attacks the hardest structure in the body, the enamel of the teeth, and destroys it just as a cancer may destroy the soft tissues of the nose.

Thinking of disease, then, as a local death and disintegration of tissue which, if unchecked, leads to death of so much tissue that the organism as a whole dies, let us note the progress of dental disease.

It has an auspicious beginning, attacking and destroying, as I have said, first, the hardest substance in the body, the enamel; and then it immediately attacks the next hardest tissue, the dentin.

If unchecked, this destructive activity, this death-process, next attacks the pulp and destroys it.

Then it passes through the tooth out into the bone, and destroys bone. Always the same: this disease, this *something* I have called the death-process, always the same in that it is progressive death and destruction of vital tissue.

From the bone, it spreads to any part of the body: to the kidney, causing nephritis, to the stomach, causing gastric ulcer, to the joints, to the heart, to the eye, almost anywhere. It seems probable that even the carrier itself, the blood, may be attacked, causing erythropenia and other degenerative changes.

What I am saying is, of course, not new. But the way I present it is perhaps individualistic, and I want you to look at it my way for the moment. I want you to get the idea of the death-process as a moving thing, entering the tooth, going through it and so into the bone and the body. (Fig. 4.)

It is our duty as dentists to keep this death-process out of the body. How?

Once it has gone as far as to destroy the pulp, or farther, can we always stop it with *certainty;* keep it from reaching the vital organs? We *cannot*, not with *certainty*.

Can we keep it from starting at all by preventing dental caries? Again we *cannot*. Not today. Perhaps, tomorrow. But not now.

Can we stop it when it is in the stage of dental caries, before pulp involvement? WE CAN.

Then in the name of common sense, and for the sake of humanity, why don't we? I believe we will in the future.

Fig. 3.—The five-film interproximal examination for incipient caries (pyorrhea and other coronal and cervical lesions). Arrows 1 to 5 inclusive all point to carious cavities. Some are very small (Arrows 3, 4 and 5), while in others the enamel has been completely penetrated and considerable underlying dentin destroyed. Though it is not difficult to see in original negatives, small cavities are often indistinct or lost—owing to loss of detail—in halftone reproduction.

I have for years, on various occasions, tried to induce the American Dental Association to start a nation-wide campaign to teach the people the slogan "Never Let Your Teeth Ache," which is a way of teaching them to preserve dental pulps. These efforts have come to little, for which there seems to be no occasion for grief, since it seems likely that the results I sought to gain are about to be realized in a little different way; that is to say, in the natural course of events, by the development of the interproximal roentgen-ray examination. A great enterprise usually hangs on a peg, if you know what I mean. For example, the recent clean-up of septic mouths in America hung on the peg of the general roentgen-ray examination. The future preventive dentistry will I believe also hang on a roentgen-ray peg; the interproximal examination, made periodically.

V

Dr. Kells says that any dentist who cannot find "any cavity of decay on any tooth" with the explorer and mouth glass needs a competent assistant to make his examinations for him, and not a roentgen-ray machine. I have put the matter to a practical test. Permit me to report that test.

A woman of 21 or 22 was selected as a patient. She had what is commonly called "a pretty good set of teeth." An interproximal roentgen-ray examination was made, which resulted in the following findings: one large proximal cavity, two medium sized proximal cavities, two very small proximal cavities, an overhanging proximal filling and a proximal filling failing at the cervical; seven findings **in all.**

This patient was then sent to ten dentists for an ordinary ocular, instrumental examination. She was instructed to ask each dentist to examine her teeth for cavities and to inquire particularly if any were found "in between the teeth."

Of the ten dentists visited, two found the large cavity and were suspicious of one of the medium sized

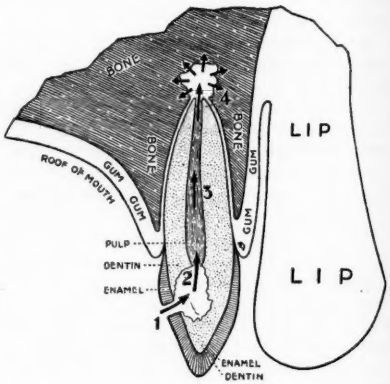

Fig. 4.—A schematic drawing illustrating the progress of dental disease (characterized by the destruction of tissue) from simple dental caries to bone destruction and on into the general system. First, dental caries penetrates the armour of protective enamel, Arrow 1; thence, through the dentin, and into the pulp, Arrow 2; on through the pulp, Arrow 3, and through the tooth, out into the bone, Arrow 4; and from there, to all parts of the body as suggested diagrammatically by the "burst" of six little arrows.

ones; that is, let us say, two dentists found two out of the seven cavities. Six dentists found the large cavity and nothing else; that is, only one of the seven lesions. And two of the dentists found nothing. In brief, ten out of ten did not find what the

roentgen ray had revealed. All ten, if we are to believe Dr. Kells, "need competent assistants, and not a roentgen-ray machine." To condemn these ten dentists, to in a manner, summarily discharge them and employ dental assistants in their places, comes mighty close to condemning all dentists, for these ten are representative of the profession. They are not inferior men by any manner of means, and, in the number, are included men from a large city, from a small city and from a little town. I would have included Dr. Kells himself if it had been possible to do so.

Of course, there would be nothing gained by discharging all dentists and having dental assistants take their places. The physically impossible is impossible to dental assistants just as to dentists themselves. And it is physically impossible to find, by ordinary ocular, instrumental methods, all the interproximal lesions consistently revealed by the roentgen ray.

It is not good for us or our patients to fool ourselves into believing that we can accomplish the impossible. Some used to claim that they filled *all* pulp canals to the very end, always. Dentistry is a better profession since we have thrown this absurdity overboard and frankly admit that there are countless numbers of canals we cannot fill to the end.

Medicine and dentistry advance as we eliminate bluff and pretence. Medicine has advanced a long way from the physician who made a diagnosis by feeling the pulse and looking at the tongue, to the man who relies on a well-equipped pathologic laboratory.

There is much of bluff and pretence in the examination of the teeth for carious cavities. To advance, we must eliminate it, and to eliminate it, we must give a better examination of the proximal surfaces; and this can be done only by the use of the roentgen ray.

VI

Dr. Kells says "Our patients, as a rule, are not devoid of common sense." He says that they have too much sense to pay for periodic roentgen-ray examinations for caries when they might "go to some other dentist and have these cavities discovered by a simple examination." Dr. Kells' logic is good, but his premise is wrong: dentists cannot be depended on to find the cavities by what Dr. Kells calls "a simple examination," as I have already shown.

I too believe that most of our patients have common sense, and that is why they will have periodic interproximal roentgen-ray examinations made. To illustrate the truth of this statement, let me cite another case:

In a woman, aged 19, interproximal roentgen-ray examination gave ten findings, proximal cavities and failing proximal fillings. Of these, eight were in need of immediate attention. That is to say, the caries was extensive enough to indicate immediate excavation and filling, or refilling. The other two were extremely small.

This patient was referred to her family dentist, a Chicago man, without negatives or a report, and with instructions to explain to him that she was about to leave her home for the winter to attend the University of Wisconsin, and "would he please examine her mouth carefully in order that she might have any work done that needed doing, so she would be sure to be free of dental trouble while away at college." She was instructed to inquire particularly if he found any cavities between the teeth.

Of the ten lesions, eight needing attention at once, this man found only one.

Under such care as this, it is inevitable that this young woman would lose pulps (and so, in time, teeth). And the blame would rest squarely on the head of the dentist.

In the letter telling me her dentist had found only one cavity, she said: "Could you please recommend a good dentist?" So the common sense that Dr. Kells says will keep patients from having periodic interproximal roentgen-ray examinations and cause them to turn to dentists who do not employ such examination is more likely to work the other way round.

Of course there was no occasion for the young woman changing dentists, as far as my experiment was concerned. It was John Wesley—wasn't it?—who said, on seeing a drunkard, "But for the grace of God, there goes John Wesley." Likewise, but for the grace of God, almost any one of more than 50,000 dentists in America might well have been the Chicago dentist. No dentist can make an ocular, instrumental interproximal examination that equals a roentgen-ray examination, and the quicker we admit this obvious truth, the better. It is absurd to blame men for not finding proximal cavities by instrumental and ocular methods. We get nowhere by casting blame; we progress by admitting truths.

VII

Dr. Kells says: "Superficial decay on proximal surfaces of teeth in contact with each other will invariably look suspicious to the trained eye, whereupon the teeth should be separated and this superficial defect polished off. It would simply be impossible for such superficial decay to show on a film." I wonder why he thinks it would be impossible for superficial decay on a proximal surface to show in a roentgenogram. Dr. C. O. Simpson states, and submits evidence to prove his statement, that the roentgenogram will reveal a decalcified spot on the proximal surface of a tooth before a cavity exists, when the decalcification has but just started. Such a cavity is, one might say, chemical instead of physical and it can be revealed with the roentgenogram because the roentgen ray records densities. Such cavities in the "proximal surfaces of teeth in contact" cannot be detected by the naked eye. One may as well claim to be able to diagnose tonsillitis by examining the tip of the tongue. There comes a time when a proximal cavity gets large enough, when one can detect its presence by the appearance of the occlusal enamel, to be sure. But there is also a time when a proximal cavity exists and the enamel within the range of vision has not been acted on at all; when no macroscopic change whatsoever has taken place in it; when it is indeed debatable if even a microscopic or chemical change has taken place.

But the discussion becomes too pedagogic. Why discuss the matter of locating the most incipient form of proximal decay by eye when even large cavities are constantly being overlooked by able practitioners?

VIII

Dr. Kells says there are many cavities easily seen or located with an explorer that could not be revealed by the roentgen ray, "owing to their position" in the tooth. (Does he inadvertently admit that proximal cavities can be revealed?) It is entirely true

that many cavities in teeth that can be located by the eye or with an explorer cannot be located roentgenographically. But that is only half the story. The other half is that many proximal cavities that are not and cannot be located by eye or instruments *are* revealed by roentgenograms. Dr. Kells seems, in this instance, to be able to detect the limitations of the roentgen ray but unable to detect the equally apparent limitations of ocular and instrumental examination. Roentgen rays will, of course, never take the place of explorers and mouth mirrors; nor will explorers and mouth mirrors ever enable us to see in between the teeth as we are able to see with the roentgen ray, which we need to examine in the dark inaccessible places, just as we need flashlights to see in dark places. We do not examine occlusal, facial and lingual surfaces with the roentgen ray any more than we would use a flashlight to examine a spot flooded with sunshine. But we do need flashlights in the closet and in the cellar, and we do need the roentgen ray to make interproximal examinations.

It has not been so many years since Dr. Kells read a paper in an eastern city in which he advocated the use of the roentgen ray to locate impacted teeth. Dr. Cryer told Dr. Kells at that time that he (Dr. Cryer) would rather trust a steel probe any day than the roentgen ray. I appeal to Dr. Kells: He knew how certain he was at that time that the roentgen ray would be used to locate impacted teeth. I tell you it is just as certain that it is going to be used to locate incipient proximal decay. A steel probe for locating impacted teeth is a useful instrument, and a steel probe (explorer) for locating cavities is also a useful instrument, but these instruments have limitations and should not be used to the exclusion of the roentgen ray.

IX

Dr. Kells asks how many radiodontists examine their own mouths periodically to find proximal decay—an excellent question, one well calculated to throw light on the subject. As far as I know definitely, there is only one radiodontist who examines his mouth periodically for proximal caries with the roentgen ray. I am that one. But then I have been the only one who knew a practical method of interproximal roentgen-ray examination that could be made in five (or seven) exposures. I did not make periodic roentgen-ray examinations of my own mouth before I developed the simple method of doing it, when I would have found it necessary to make from ten to fourteen exposures. So whether I make the examination for myself or not seems to hinge on how difficult it is to make such an examination. I did not make it when it was difficult, but I do make it now that it has been simplified and made easier. Dr. Kells evidently desires to bring out that what applies to the radiodontist himself may well apply to patients, and I agree with him in this, though it is proverbial that the "shoemaker's wife goes barefoot."

In this connection Dr. Kells urges that we be consistent. After giving this excellent advice, he himself perpetrates the inconsistency of saying, or at least seems to me to say, that decalcification (caries) cannot be seen in teeth but can be seen in bone. He says "The radiolucent area (seen in

roentgenograms at the apices of roots) means nothing more or less than that decalcification of that area has occurred . . . ."

X

Dr. Kells invites me or "any radiodontist," to "play blocks" with him. He proposes investing dissociated teeth in blocks of paraffin, then roentgenographing them and so making a study of the roentgenography of dental caries. I decline the invitation. I am aware that such declination is frequently taken as evidence of fear to undergo the experiment, lest it might prove the challenger right and the challengee wrong. Some will think this the case no matter what I may say. For those who want to know the truth, I will say this: The proposed experiment simply does not appeal to me as worth doing. If Dr. Kells wants to prove that caries on surfaces other than proximal surfaces will not register on the roentgenogram unless the cavity is very large, we do not need to conduct experiments to prove the point. I admit it. If he wants to prove that proximal decay will not register if the roentgen-ray angle is wrong, we need not conduct experiments to prove that point either, for I admit it also. In fact, I will admit anything that can be verified by experimentation in the mouth itself or is not disproved by clinical experience and experimentation.

I will say this, however: If Dr. Kells will himself conduct the experiments that he suggests, and will then show me results that rouse my interest and stir me to the wish to make investigation, I will join him; I will feel compelled to. In the meantime, I shall stick mainly to investigation directly on the patient himself, believing this to be superior to any investigation under what might be broadly termed artificial conditions. I may add that, in case of apparently conflicting evidence, I shall always, of course, accept that acquired directly from the patient in preference to that acquired by experimentation outside the mouth.

One more point in this connection: I have spoken repeatedly of locating proximal decay by means of the roentgen ray. I must not give the impression that occlusal decay can *never* be seen, for it can. But that fact is merely incidental. We surely need no help from the roentgen ray to locate occlusal decay; we *do* need help to locate proximal decay. Ordinarily, occlusal decay is better located with explorers, just as proximal decay is better located with the roentgen ray. But, merely to record the fact, it may be said that occlusal cavities, if large enough, will register on the roentgenogram. Facial and lingual cavities will not register unless they are quite large. It is fortunate indeed that the surfaces most inaccessible to ocular and instrumental examination are the very ones most efficaciously examined by roentgen ray.

XI

Dr. Kells mentions the names of four men and says that if these men consider roentgen-ray examination for proximal caries unnecessary, we may be assured that it is actually unnecessary. I do not agree that such reasoning is sound, no matter who the four men might be; but I shall not argue that point. I do not need to.

Advanced proofs of a series of ar-

ticles on the subject of preventive dentistry and interproximal roentgen-ray examination[2] were sent to a few carefully selected men for their opinion. The men selected happen to include two of the four men mentioned by Dr. Kells, and they have been kind enough to write me their opinions of my work.

I quote Dr. Johnson: "You've struck it! I blush when I think of the cavities I have probably overlooked, and that's why you have ruined this evening for me. Curiously enough, I have been somewhat disturbed over this very question of late, having noted cavities in several instances in the films when they had been made for other purposes. But your demonstration clinches it." Dr. Johnson's letter reached me just a day or two ago; he probably read my proofs and wrote to me since he read Dr. Kells' paper and wrote his discussion of it.

I now quote from a communication from Dr. Hinman: "What you say about careless inspection of the mouth is verified every day in my practice. Patients are continually coming in who claim they have had recent mouth examinations, and I find most frequently cavities and often pyorrhea either in an incipient or an advanced stage."

Dr. Johnson makes his admission personal. Dr. Hinman doesn't go that far, but he does admit that other dentists fail to find cavities.

Dr. Kells plays to a little hard luck. With more than 50,000 dentists to choose from and only about eight who have had a view of my advance proofs and written me their opinion, he selects two of that eight.

Since I am quoting the opinion of others, allow me to quote Dr. Charles H. Mayo. Dr. Mayo has said little about dental matters, but what he has said goes so directly to the point that he has been quoted more than almost any other man of the medical profession. "The X-ray has, especially by indicating diseased roots and changes in the bone from decay and inflammation, greatly advanced dentistry, and it has added much to our knowledge of focal infection. The new film developed by Raper for showing decay in the crown will enable dentists to locate these areas much earlier, and fewer cavities will be missed in examination. This development is a true conservation."

That statement reveals more discernment than is at once apparent. "This development is true conservation." That is just exactly what it is. A form of conservation that saves teeth at the expense of health is a ridiculous form of conservation. Indeed, it is not conservation at all; it is waste. To conserve pulps is to conserve teeth without risk to health, and that is exactly what Dr. Mayo calls it: "true conservation," as distinct from the old foolish, false kind.

XII

It has long been a rule of dental practice to fill cavities as soon as they are located. An excellent rule; but old rules must be modified or taken with a grain of salt when new methods are developed. The roentgen ray is, of course, not new, but, as a means of examining for proximal decay, it may be looked on as a new and powerful agent, and should be handled accord-

2. Raper, H. R.: Internat. J. Orthodontia, to be published.

ingly. An agent that holds great capacity for good, as does the roentgen ray as a means of locating proximal decay (and other interproximal findings), usually holds also some capacity for harm. Even anesthesia—perhaps the greatest of all medicinal agents for good—has been the instrument of harm, in that it has been the cause of needless operations.

I have already suggested in this article that there are some cavities revealed by roentgen-ray examination that should not be filled immediately, but should be kept under periodic roentgen-ray examination. Men to whom I have sent advance proof of my work have objected to this advice. My practice in this connection seems to require explanation.

The roentgen ray enables us to discover proximal cavities that have remained undiscovered, and at such an early stage in their development that their management becomes a new, heretofore unfaced problem. I have not infrequently found as many as from ten to fourteen very small cavities in the mouths of patients in their late teens and early twenties. These patients, by the way, were unaware of having any cavities. By very small cavities, I mean those that have just nicked the enamel and have not as yet attacked the dentin. Imagine entering from the occlusal and cutting out, say, ten such cavities in the *posterior* teeth of a 19-year old patient, just because we are discovering, for the first time, that such cavities are present. We are not justified in pursuing such a practice; it is too radical. It necessitates cutting away too much sound tooth structure. We know too little as yet about the rapidity of development of such cavities. We should proceed carefully.

One of my friends, Dr. Frank Hamilton, who at first rejected my advice to keep very small proximal cavities in posterior teeth under roentgenographic observation in preference to filling them at once, writes me: "I am beginning to realize that all the cavities shown in the roentgenogram should not be filled, but it will always be a fine point to decide just where to stop." Others, I think, who at first were inclined to reject my advice along this line will be more inclined to accept it after they have had further experience and have given the matter more consideration. But I cannot discuss this phase of the subject further in this paper, though there is much more to be said. Perhaps we may develop some effectual method of stopping the development of such cavities; the thought is fascinating. . . .

XIII

Dr. Kells says that neither he nor his wife nor his daughter nor his two grandchildren have a pulpless tooth and that none of them have ever had a roentgenographic survey of their mouths. I wonder if any of them have an undiscovered proximal cavity. Since they have never had a roentgenographic survey, I contend that the absence of such a cavity has not been proved.

But I do not mean to say that it is impossible to save pulps unless periodic roentgen-ray examinations are made for proximal caries. What I do claim is that the conservation of pulps is made easier and far more certain by the employment of the periodic roentgen-ray examination. And it seems foolish to attempt a thing in the more

laborious and less efficient way when a better way is at hand. Why insert proximoclusal foil fillings when we have inlays? Why insist on riding in a buggy while others ride in automobiles? Why depend on inadequate methods of making interproximal examinations when we have the roentgen ray at our disposal?

I know a man past 60 who has not lost a pulp for years. He is one of the most faithful patients I have ever seen. It is literally true that I met him in a dental chair, the chair of a mutual friend. He has for years consistently selected the best dental talent to be had in his little city and has never been remiss about his periodic examinations. Owing to the changes in the personnel of the dentists of his city, and not to his fickleness in changing dentists, he has been under the care of four men since I have known him. Recently, he presented himself to his dentist complaining of distinct annoyance in the lower right posterior region. His dentist found a small cavity and filled it. The patient returned in a few days, the annoyance unabated. He was referred to me for roentgenographic examination. The astonishing findings revealed in this case are illustrated in Figure 5. The cavity in the distal of the lower right second bicuspid almost exposed the pulp. The cavities in the distal of the upper left second bicuspid and mesial of the first molar are very large. I believe this roentgen-ray examination saved the patient the pulps in at least three teeth.

If Dr. Kells says that these cavities should have been found without the roentgen ray, I reply simply that they were not. And, I repeat, the dentists who figure in this case were what we all call "good men."

Fig. 5.—Case from practice. Arrows 1, 2 and 3 point to large carious cavities. Arrow 4 points to filling failing at cervical in tooth with vital pulp.

I would not lead my readers to believe that they are likely to encounter cases such as the one just reported, often. It seems a rather unusual case to me. I report it because it illustrates the case of a patient who was apparently in a position of perfect security from needless dental trouble, but who was, in reality, and to use rather graphic language, sitting on a dental powder charge with the fuse leading to it lit and sputtering.

XIV

It does not fall within the province of this already overlong paper to describe the technic of making interproximal roentgen-ray examinations. I may nevertheless give the reader

some idea of how they are made. My first experiments were made with filmholders of various designs, and while it is possible to make the examination with holders, it is very unsatisfactory. I finally discarded holders altogether and made what I have called bite-wing film packets. I have found them superior to holders in every way. It is likely that some men will attempt to use various makeshift holder devices, and I know from experience that their results will not be what they should be. When this occurs, I hope these men will not condemn the method itself, but will proceed then to give it a fairer trial. The method holds such great possibilities for good to humanity that it would be a shame to retard the realization of these possibilities.

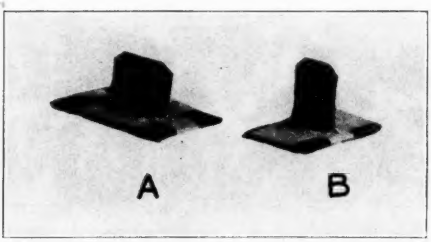

Fig. 6.—Bite-wing film packets: *A*, posterior packet; *B*, anterior packet. The packets here illustrated are homemade. Film packets of this type may now be obtained, already made up, from the Eastman Co. Special size films are necessary.

Figure 6 illustrates some bite-wing film packets; i. e., films wrapped up in a packet with a tab attached in the central region of the sensitive face of the packet, so that, when the tab is held between the teeth, the film is held in the patient's mouth in such position that the upper and lower teeth (coronal 2/3) may be roentgenographed simultaneously. (Figs. 7 and 8.) The packets illustrated here are rather crude; they are homemade. The Eastman Company now makes these packets. The manufactured packets are of course far superior to homemade ones. Special size films are necessary. I have tested many different sizes in an effort to learn those best suited to make a complete examination in the minimum number of exposures, and I hope that, as this type of roentgen-ray examination develops, it will become the routine practice, as far as practical, for men to make *complete* examinations. I am afraid we, as dentists, are too prone to examine and treat the mouth a section at a time, taking care of one section while we let the balance of the mouth go.

XV

Long as this discourse is, I have not attempted to discuss the whole of Dr. Kells' paper. To do so would require a book; I mean that literally. I have devoted my discussion to only one of the seven fallacies mentioned by Dr. Kells, the most important one, the one

Dr. Kells himself devotes most space to.

The answering of Dr. Kells is no small task. He brings up nearly all points. To answer him comes very near to answering the whole opposition. It is scarcely inaccurate to say that Dr. Kells *is* the opposition. I do not say that disparagingly. Dr. Kells is one of dentistry's most useful men.

Fig. 7.—Buccal view of bite-wing film packet in place for the posterior teeth.

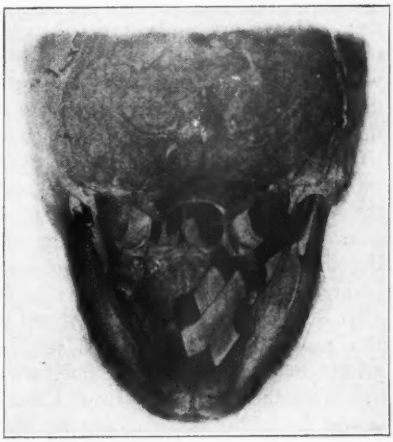

Fig. 8.—Same as Figure 7, lingual view. (Figs. 3, 4, 6, 7 and 8 from the International Journal of Orthodontia, Oral Surgery and Radiography.)

The profession needs a challenger like Dr. Kells. An idea that cannot weather fair antagonism is no good. Antagonism brings out not only weaknesses but strength as well; it reveals the difference between the real and the false.

As I say, it is out of the question to attempt a general discussion of Dr. Kells' paper, but I may say this: He fails to point out what seems to me to be the most important, most fundamental and most nearly insurmountable limitation of all. To tell you what this limitation of roentgenograms is, I must first make an arbitrary classification of pulpless teeth based on roentgenographic findings: Class 1. Those pulpless teeth that show definite evidence of periapical bone destruction. Class 2. Those pulpless teeth that may or may not show evidence of periapical bone destruction. Class 3. Those pulpless teeth that show no evidence of periapical bone destruction.

A further word seems necessary to explain the grouping of teeth in Class 2. I mean those pulpless teeth in which the roentgenographic evidence of periapical bone destruction is so indistinct or indefinite that different operators will have different opinions as to whether there is any evidence discernible at all or not, and the same operator may hold different opinions

at different times, thinking he sees tissue changes when he looks at the roentgenogram one time, and failing to see them another.

It is pretty generally conceded that teeth of Class 1 require treatment of some sort, extraction or otherwise. (I said pretty generally conceded. I did not say that Dr. Kells concedes it.) But what to do with those of Classes 2 and 3 is a serious problem for the man in clinical practice. There are among these—if we are to believe our most trustworthy research workers, and who else is there to believe?—teeth that are safe and others that are distinctly dangerous as far as health and life are concerned, and the roentgen rays never can enable us to distinguish the one from the other. That, it seems to me, is the most important and the insurmountable limitation of the roentgen ray.

It does not fall within the scope of this paper to attempt to tell of the efforts made to distinguish the harmful from the harmless teeth of Classes 2 and 3. Suffice it to say that the differentiation is based upon a consideration of the essential nature of the systemic disease of each particular case, the state of the general health and the results of the standard laboratory health tests such as blood count and urinalysis. That such methods do not yield exact results must be apparent, but they represent the best we can do. At any rate, it seems improbable that the roentgen ray will ever help us further than to reveal whether or not we have structural change in the periapical bone.

All of which, intelligently interpreted, is a most forceful argument for the prevention of pulpless teeth, and, while the roentgen ray does not give us the help with pulpless teeth we would like to have, it is able to give us all the further help that we need to prevent pulpless teeth.

The prevention of decay is something to strive for; the prevention of toothache (due to pulp exposure) is something to accomplish.

Much as I have written, I have told but a very small part of the story of clinical preventive dentistry based upon the interproximal roentgen-ray examination. The subject is by no means exhausted. It never will be, as long as there are such things as health, disease and a dental profession.

THE APPLICATION OF BIOLOGIC PRINCIPLES TO THE PRACTICE OF PERIODONTIA

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THE practice of dental science is changing rapidly. New methods of treatment are being constantly evolved, new theories of causes brought forward and discussed, but the fundamentals of biology remain unchanged. In our preliminary training in the medical school, such biologic subjects as embryology, histology, physiology, bacteriology and pathology were considered as fully as time permitted in order that a substantial scientific basis for our life vocation might be had. After we entered the dental school, these basic subjects, unfortunately, were forced into the background, more or less, because the teaching of others assumed such an important aspect and occupied so much of the prescribed time. These basic subjects, in a great measure, consisted of operative and prosthetic dentistry, each of which demands a development almost entirely mechanical. As a consequence, the latter subjects assumed an overwhelming importance over the earlier ones, which was not rightfully deserved.

In the years of practice that have followed, this predominance has continued. It is no exaggeration to state that those subjects which most interest our profession concern mechanical operations, exception being made to the root-canal problem. The average practitioner has little time for the consideration of preventive dentistry, for instance; his greatest concern is for the strictly practical part of our work (using the word practical as already mentioned). It is recognized, of course, that such subjects should vitally concern him. In his effort to make himself efficient, so that his work may be of value in point of service to his patients, it is necessary that he should perfect himself in new methods pertaining to these subjects as they are presented. Thus, the fundamentals of his education, without which he could not practice his profession, are forgotten, in great part at least. It is this fact, for instance, which influences many to neglect the important subject of mouth hygiene and, when it is forced on them by circumstances, to transfer the cleansing of the teeth and care of the mouth to an assistant or dental hygienist because the press of other duties demands their attention. If, however, the value of oral hygiene, which periodontists know has such a vital influence on cell metabolism, could be impressed on them in a proper manner, this branch of dental service would undoubtedly receive the attention that it rightfully deserves and would also assume the importance it should occupy in the estimation of his patients, who, in the ultimate, reflect the result of the practitioners' opinions.

In the practice of treating periodontal disease, one cannot afford to ignore fundamentals. In order that the periodontist should understand and apply this knowledge, he should possess a thorough understanding of the biologic factors that underlie their application. Our study of histology taught us that the basis of all animal life is the cell, and that of pathology showed that any alteration or change that the cell may undergo directly concerns us in our treatment of diseased areas. To crowd these subjects to the background would indicate a serious lack of appreciation of their value and an inability to grasp many important biologic theories or facts that are presented for our consideration from time to time. At present, for instance, an endocrine theory has been advanced that concerns us most intimately. It relates to a possible disturbance of the internal secretory glands that would result in a change of the calcium metabolism. This, in turn, would bring about a deficiency of the lime content of the cell, which would affect all bodily tissues. Should this theory be proved, it would establish for all time the responsibility for the disintegration of the entire periodontium and the resultant development of periodontal disease. It has not been proved, but the fact that it is being considered and studied serves to show how necessary it is for us to keep in mind a knowledge of biologic laws so that such theories may be readily understood as they are presented to us.

Biology is the science of life. Life brought down to fundamentals is cell metabolism. Cell metabolism consists of taking suitable nutrition into the cell, converting the same into energy and excreting the unfit. Cell life is made up of degenerative and reparative processes, as shown by the body tissues. In other words, cell function, in which chemistry is so important, constantly undergoes changes. As an example, in the phenomenon which we know as respiration, the blood cells carry oxygen, which is assimilated by the tissue cells as latent energy, and is converted after use into carbon dioxid. This product, if present permanently in excess of oxygen, would produce marked degenerative changes in the protoplasm of the tissue cells and result in ultimate death. When this poisonous gas passes back into the blood plasma in the process of excretion, there remains a deficiency of necessary oxygen in the cell tissue, but fresh oxygen immediately replaces it, and thus normal cell function is maintained.

We, as dentists, are not as a rule accustomed to consider and apply the principles of cell life to our work. In the treatment of periodontal abnormalities, for instance, we are inclined to begin a diagnosis with tissue injury as a basis. It is with this thought in mind that this paper was written, and in the hope that it might present to us a fuller conception of the fundamental importance of applied biology.

As has been stated, normal cell life represents a condition of balanced metabolism, which, reduced to simple terms, means that every cell is receiving the proper amount of nourishment necessary for its maintenance and is excreting the unfit, thereby performing its part in the great whole which we know to be health. In order to treat diseased periodontal areas, we should not focus our attention on tissue disturbance too strongly. One hardly realizes what a wonderful

process normal cell life is, and it is only by a study of this phenomenon that a suitable appreciation of the coordination that exists in the contents of the cell protoplasm and between individual cells is had. Our duties demand that we should possess not only this knowledge but also that which concerns a disturbance of this coordination.

Mallory[1] states that, whenever an injury is produced by an irritant, there is a chemical change in cell metabolism in both secretion and excretion, and a morphologic change due to an alteration or impairment of the functional activity. The clinical changes resulting from the morphologic and physiologic disturbances are designated as lesions, signs and symptoms, and they constitute diseases which are characteristic of the irritants responsible for them. The morphologic changes, such as exudation of serum, emigration of leukocytes, lymphocytes, etc., and diapedesis (passing of red blood corpuscles through breaks between the endothelial cells of the capillaries, which takes place when the injury is severe), concern the circulation. Cell inflammation, in and around an injured area, may produce cell proliferation, caused by the elements which induce the inflammation of the endothelial cells. The inflammatory products are composed of endothelial leukocytes, lymphocytes, fibroblasts and endothelial cells.

The changes in cell integrity take place in the following order: Circulatory disturbance: 1. Inflammatory exudation: (*a*) exudation of lymph including formation of fibrin; (*b*) emigration of leukocytes, chiefly polymorphonuclear. This is often contaminated by red blood corpuscles owing to diapedesis (hemorrhage). 2. Proliferation of emigrated endothelial leukocytes, lymphocytes, fibroblasts, vascular endothelium and epithelial cells.

These changes, the four cardinal signs of acute inflammation, produce redness, heat, swelling and pain, and are the usual reaction to inflammation. Our work, however, greatly concerns irritating agents that are present over a long period and that produce slow or chronic changes in the cell, although we often treat acute conditions as a result of severe bacterial irritants which develop strong toxins; Vincent's infection being one of these. Some of the mild injurious agents are those micro-organisms that produce weak toxins. Included in this class are strong toxins from various sources, which, if sufficiently diluted, may act as mild irritants. The injury to the cell caused by mild irritation cannot be demonstrated morphologically, but the inflammatory reaction is usually marked after a more or less protracted period.

Mallory divides injurious or cell irritants into three classes: (1) mechanical, such as an incision, a blow or foreign body; (2) physical, such as heat, cold, sunlight, electricity, roentgen ray and radium; (3) chemical-organic, inorganic, such as (*a*) acids, alkalis, poisons, and (*b*) toxins from infectious agents, such as bacteria and protozoa.

Applying this statement to our work, we find that the mechanical and chemical factors produce the most common form of cell irritation. The mechanical may include traumatic occlusion, calculus, rough cervical margins of fillings and poorly

1. Mallory, F. B.: Principles of Pathologic Histology, 1914.

fitting crowns. The physical—heat, cold, sunlight, etc., do not concern us or are practically negligible. Chemical factors, both organic and inorganic, are responsible for much periodontal disintegration. The inorganic may include poisons such as mercury, phosphorus, etc.; the toxins are those formed by bacteria and protozoa.

Cell protoplasm, at rest, is in a state of equilibrium, and any outside stimulus either physical or chemical that upsets this equilibrium releases certain constituents of the protoplasm and sets free associated functions that are the phenomena of physicochemical cell reaction. This ability to enter into relationship with and respond to stimuli is called cell irritability. When this stimulus and cell reaction remain within the range of adaptation so that cell structure is not altered, equilibrium will not be disturbed and no pathologic condition will ensue, but if cell equilibrium is temporarily or permanently affected injury will result.[2] Reduced to simple terms this statement means that every cell possesses an inherent power to react against injury. Call it individual resistance, idiosyncrasy or whatever you will, the fact remains as stated. If the injury is not too severe or of too long duration, the destructive process or processes responsible for it are overcome by the activity of the cell, and thus healing and a state of balanced metabolism again results. If the injury is severe, whether acute or long sustained, it develops what we, for want of a better term, call a lowered resistance, and the cells then undergo degenerative changes, which eventually destroy them. Using this statement as a basis, the following thought is brought to your attention.

The services that we render our patients consist in the main of diagnosis and treatment. It is needless to state that one without the other would be of no value. Treatment consists of the removal of irritating factors and stimulation of the soft tissue, both of which are expected to induce cell repair. Before the irritating factor or factors are eliminated, there is a disturbance of cell metabolism in which suppuration, either visible or not, is present. When one has succeeded in eliminating all irritants, the formation of granulation tissue immediately begins, continuing to completion, unless disturbed. It may be well at this point to consider how granulation tissue is formed:

> On an inflamed surface is seen a layer of leucocytes and with it may be a few fibroblasts and large hyaline cells. Immediately beneath these, the dilated superficial capillaries show tiny buds or thickening of their endothelium directed toward the surface. These buds elongate and send processes outward which are joined by other adjacent capillaries. These thicken, are hollowed by the blood stream and assume characteristics of new capillaries. From these loops, others are formed which advance into the area to be filled until it is entirely obliterated. This mass is supported by connnective tissue cells (fibroblasts) which have simultaneously proliferated. This is granulation tissue. (Adami and McCrea.[3])

It has been the custom of many in the past to overemphasize root curettement. In fact, many today practice only the removal of tooth and root deposits and then apply medicaments for the complete treatment of cases. Our knowledge of cell repair just touched on shows this to be a most unwise and improper procedure. In-

2. Oertal, Horst: General Pathology, New York, Paul B. Hoeber, 1921.

3. Adami and McCrea: Textbook of Pathology, 1912.

stead of Nature being assisted to bring about recuperation in her own way, granulation tissue is constantly injured, and because of the employment of this form of treatment, the irritation present at the beginning of the treatment period is increased by repeated curettement.

It is here that a knowledge of cell response to injury and natural tendency toward repair when the cell is freed from irritation is valuable. This fact, which applies as well to those who vainly place dependence on the use of proprietary or other preparations in treatment, brings before us another point that is worth consideration. In view of the knowledge of biologic laws of cell recuperation, it would seem that drugs are too often used in collateral treatment of cases; so much so that much dependence is placed on this agency for ultimate success. We have been taught to believe, or at least such was my experience, that stimulation by medication was absolutely necessary in treatment. But this theory is not always compatible with natural laws. Adami and McCrea, (page 137) state: "There is in the tissues an almost insuperable tendency to heal," adding that "the physician may succeed in killing these tender new born cells, a stream of water may wash them away and Nature may have to do her work over again on your account." This statement refers to the treatment of wounds involving the epidermal and underlying tissue cells, but there is no reason to believe that the same principle does not apply to abnormal conditions of the periodontium that we are called on to treat. In a periodontal practice with which I am familiar, there is practically no medication used for the purpose of stimulation, and while success in treatment is not 100 per cent, it undoubtedly measures up to the average. It is no exaggeration to declare that our profession in general places too much dependence on medication. Our trade journals and office mail abound in advertisements of preparations that are recommended for use in treatment of all kinds, with all sorts of claims made for their efficiency, which are not always substantiated by results obtained. This is a serious condition and one that should be remedied; for it can be stated in truth that most of these medicaments would receive no attention from us and would automatically disappear from the market, if more consideration were given to natural laws of cell repair and less to short cuts to hoped-for success. One might almost say that medicaments are contraindicated for the purpose given, but there may be cases in which the careful employment of them is necessary. The days in which the use of drugs was considered indispensable are over. Medical practitioners are placing less dependence on them during treatment and more on the natural laws of cell recuperation. Our profession must recognize this fact also.

While the indiscriminate use of drugs to assist in the formation of granulation tissue should not be encouraged, with a disregard of the natural laws of healing, proper gum massage should never be neglected. There is a growing conviction among those interested in preventive dentistry that the factor of mucous membrane stimulation must receive more attention than has been the case in the past. It is a fact that the tone of this tissue in the mouth of the average pa-

tient is poor because of the low state of metabolism of the blood cells. This condition deprives the connective tissue and epithelial cells of sufficient nourishment to keep the metabolic processes normal. With this in mind, the efforts of these practitioners are directed toward overcoming the deficiency present by direct stimulation. Massage is the best means of doing this, and of the various methods that may be employed, such as electricity, finger manipulation and brushing, the last has proved to be the simplest and most efficient. Charters has given us a method that, if properly employed twice a day, with physiologic sodium chlorid solution on the brush, will result in perfect tone of the epithelial, connective tissue and blood cells of the mucous membrane. This statement is not made from hearsay, but with a full understanding of its import, and it is based on actual experience and observation.

A gratifying result of this form of gum massage, aside from the physiologic benefit derived, is the favorable psychologic effect on the patient; a most desirable condition, as we know. If, instead of using any of the other agencies already mentioned, we would carefully instruct the patient in the proper application of this method or one similar (as advocated by some) and stress its importance as a necessary adjunctive treatment, we should develop, first, cooperation—a most important factor in treatment—and, second, the formation of a habit likely to be continued indefinitely as soon as the favorable result of personal effort is noted. To arouse the interest of the patient during treatment is immeasurably better than to depend on an outside agent, such as medication, for benefit.

As cell repair cannot progress to completion even after the irritating factors are removed because of overcurettement, it will never take place when rough surfaces are present. All cell adhesions, such as are found between the cemental cells and the fibroblasts of the pericementum, for instance, take place on a smooth surface, and when a cell lesion occurs, complete healing will not result except under the same conditions. (The term smooth is meant to designate a surface on which there is no roughness or sharp edges.) To make this possible, the root surface must present as nearly a natural condition as may be had. When, however, it is severely injured, as is the case when a deep cut or scratch is made, union will not take place. Periodontists have recognized this fact for years. Analogous to this is the statement made by Noyes[4] that "the cure of a case of suppurative periodontal disease is a biologic problem and that only under favorable conditions can reattachment take place." He states further: "If conditions are properly controlled by treatment, a new layer of cementum due to the activity of the cementoblasts will be formed but only [please note the qualification "only"] when these cells are in a normal and vitally active condition. Cemental surfaces which have long been bathed in pus may be so filled with toxins that no cell can lie in contact with them and perform its function." This statement explains why scar tissue does not form in many pockets even after all irritants present have been eliminated.

While it is an established fact that

4. Noyes, F. B.: A Textbook of Dental Histology and Embryology, Ed. 3, London, Henry Kimpton, 1921.

cells have the power of recuperation under proper conditions, it is also true that they possess a characteristic, almost selective response to injury that is decidedly marked. To illustrate this statement the following practical example may be cited:

Two patients of the same age (30 years) had an occlusal disturbance which was almost identical, both being typical Class One cases. In one case, there was a traumatic occlusion present in the molar and bicuspid region and a nonocclusion from cuspid to cuspid. Marked pocket formation was present and an examination, visual and roentgenographic, showed it to be more pronounced in the area of nonocclusion than in the traumatic area. There was much mobility of the teeth. Suppuration was rather profuse, and the tone of the mucous membrane was poor, which indicated a disturbance of the cell metabolism. There was a deep gingival abscess on the mesial root of the right inferior first molar. The other case presented nonocclusion anteriorly from molar to molar and traumatic occlusion in the molar regions. The cusps of the first molars bore the greatest stress, the attrition being so marked that they were entirely obliterated. This case showed no pockets of any kind, and the mucous membrane was firm and of excellent tone, which gave evidence of good functional power. The only abnormality observed was due to ulatrophia, and the marginal and cemental gingivae had the usual appearance associated with this disturbance. Cervical fillings in the exposed cementum of the molars were present.

The example just given is a biologic problem that has never been explained. It shows in a wonderful manner the difference between a man-made machine in which the results are exactly similar, and that of Nature's processes, which are never alike. I have been asked many times, why, in my opinion, cases that show like occlusal derangement, such as those reported here, for instance, do not show similar pathologic results; why it is that one case will show deep suppurative pockets and another a slight wasting of the marginal and cemental gingivae with no pockets; in other words, why the cells in one case will respond to an irritant with marked degenerative changes in metabolism and the response to injury will show a disturbance of the cell content of the blood vessel, connective tissue and epithelium and result in congestion, suppuration and bone absorption, while the gross tissue in another in which the irritating factor is almost identical will present good tone, limited tissue hypertrophy and slight peripheral wasting and maintain as a consequence nearly normal cell metabolism. To answer such a question fully is, of course, impossible. The future may do so, but whether it may concern an unbalanced diet during the embryonic period or an abnormal endocrine disturbance, as has already been mentioned, remains to be proved.

According to present thought the reply is that it represents a difference in cell resistance of two individuals, or that the cells of one individual differ from those of another because of variation in the immunity possessed by them to resist bacterial invasion. To bring the distinction to a finer point, it may be stated that the cells of one person possess the power of repelling certain kinds of bacterial disintegration, while those of another do not. This is well illustrated by the immunity to certain diseases shown by inhabitants of various areas of the earth. It is well known that some races of people possess a power of repelling infectious diseases not enjoyed by those of other races. A typical example is the ready contraction of tropical fevers by whites who have never visited the region previously, while the dark skinned natives

living in the same climate are free from danger of infection. Negroes and Indians have little or no resistance to infection by the tubercle bacillus, and succumb rapidly to it. The white race, on the other hand, possesses this resistance, which has been developed by centuries of contact with the disease. Negroes and Indians have no such immunity because their contact with it has been of much shorter duration.

That bacteria possess an affinity for certain tissues at different ages of an individual is best illustrated by such diseases as diphtheria and scarlet fever, which are essentially diseases of youth. The theory now held concerning acquired immunity recognizes the power possessed by those who have been inoculated with an antitoxin. It is believed that the physical and chemical constitution of the cell is so altered, as a consequence of inoculation, as to be unfavorable for the growth of agents of infection and the formation of toxins. Vaccination for the prevention of smallpox is a good example of this. The factor of the physical and chemical constitution of the cell protoplasm is beginning to be considered of great importance in the study of natural immunity also. The explanation of immunity which we are considering at this moment is the best that can be offered with our present limited knowledge. It is not entirely satisfactory when one seeks an explanation of fundamental causes, and it represents at best the blank wall that separates the known from the unknown. We can only marvel at the wonderful uncertainty of Nature's work, and in a small way try to eliminate injury and assist in the reparative process by employing our best efforts to prevent, as far as possible, the development of like degenerative changes, through the recognition and treatment of early symptoms. It is the only method by which the great prevalence of periodontal diseases can be checked.

This, in a way, covers the subject of the application of biologic principles to our practice. Much more could be written and greater details entered into, but the purpose of this paper is to remind us that we cannot afford to ignore the scientific part of our training; and to remember always that when patients whom we have treated respond favorably, it is not due to any special power that we may possess. Granted that our diagnosis and subsequent treatment have made a marked change for the better, it does not follow that we should ever leave out of our consideration the basic factor of cell metabolism and the inherent power of cell recuperation.

DISCUSSION

Olin Kirkland, Montgomery, Ala.: We, as a profession of scientific men, are too prone to pass unnoticed a great many important details that enter into the etiology and treatment of the diseases so common to the oral tissues. The most scrupulous and painstaking treatment may often result in failure because some apparently unimportant detail has been omitted. In view of these facts, it might be considered intelligent practice to enter into the minutest details of every causative factor, as well as every preventive factor, in the treatment of the diseases involving the periodontal tissues, just as the medical practitioner does in the treatment of other diseases. The progressive periodontist of today is seriously in earnest in his endeavor to understand every phase of the etiology, as well as the treatment of the lesions to which the periodontal tissues are susceptible, and the day has come when it can no longer be said with truth that so-called pyorrhea cannot be prevented or cured. Dr. Tishler has said that biology is that science which deals with living organ-

isms; that life is dependent on cell metabolism, and cell metabolism consists of taking suitable nutriment into the cell, converting it into energy, and excreting the unfit products. The cell, which is also the smallest anatomic structure in the animal mechanism, composes all body tissues, and is influenced by whatever may be taken into the digestive tract in the form of nutriment. The theory has been advanced that the endocrine glands may have an important influence on cell metabolism, with possible changes in the calcium content. Such changes would, of course, have a marked influence on the teeth and their supporting structures, and may be considered an etiologic factor in oral pathology; but it is reasonable to assume that a small number of individuals are susceptible to endocrine abnormality as compared to other etiologic factors involved in the development of periodontoclasia. As balanced cell function is controlled by the food elements taken into the alimentary tract, it is feasible to suppose that diet has a more direct influence on general cell metabolism than any one factor that we may suspect as being responsible for abnormal changes occurring in cell activity throughout the body. The endocrine theory, if it is correct, would most surely mean that a marked influence was exerted on the periodontal tissues, and it cannot be doubted that diet is an etiologic factor, but as far as our present knowledge is concerned, mechanical and chemical irritants are perhaps in the greater measure responsible for the disturbance of normal cell activity in the supporting structures of the teeth. The ideal method of handling periodontal disease would, of course, be through the application of preventive measures; and whether its inaugurating cause is due to the influence of the internal secretory glands, diet, occlusal trauma or irritants, the fact remains that these lesions are omnipresent in the mouths of those whom we serve, and until the theories now being advanced as to etiologic factors are proved, we must resort to practice based upon such conclusions as those already accepted. I am in hearty accord with Dr. Tishler in his opinion concerning the use of medication in the cure of periodontal lesions. With sixteen years of experience in the practice of periodontia, I can truthfully say that I do not recall an instance in which I was favorably impressed with results obtained through the application of medicinal agents to diseased areas in periodontal lesions. The only indication for drugs in the relief of those diseases common to the periodontium is in the form of mouth washes and dressings following surgical procedure. The discoverers of sure-cure medicinal formulas, for the cure of so-called pyorrhea, always suggest prophylactic measures or massage, and usually both, as an adjunctive treatment. The temporary response in such procedure is not in any way due to the action of the medicinal agent used. The improved appearance of the gingivae usually observed as the result of such procedure is entirely due to cell stimulation influenced by the removal of mechanical and chemical irritants and massage, which forces the congested blood from the capillaries in the inflamed tissues, permitting healthy blood to take its place. Dr. Tishler is quite correct in his assertion that excessive or unskilful curettement, practiced to the extent of producing fissures and grooves in the root surface, is contraindicated, and will prevent cell regeneration in the tissues contiguous to the root surface so treated. However, I do not think it is possible to secure pleasing results in the treatment of periodontal lesions without curettement to the extent of removing all irritating deposits, including the necrotic alveolus and pericementum. Much has been said and written in the recent past concerning traumatic occlusion, and it is undoubtedly one of the most important etiologic factors in periodontal pathology. The correction of occlusal stress is of vital importance and must be given careful consideration if we hope to promote cell repair in the treatment of the periodontal structures, but in our enthusiasm over new discoveries, let us not direct all our efforts to the consideration of the new theory, to the exclusion of all others.

There *are* other etiologic factors, and the highest attainment of successful results may be anticipated only by giving the most thoughtful attention to every possible factor that may enter into the development of disease. Much good may result in the treatment and prevention of periodontal disease through careful study and the application of biologic principles involved in the practice of periodontia.

G. A. McJimsey, Dallas, Texas: Dr. Tishler has hit the keynote of the problems we encounter in our work, and our success will be no greater than our understanding of those fundamentals he has so aptly brought to our attention. Perhaps if in the practice of periodontia there were no other points of con-

tact on which we had to depend for the application of biologic principles, we could "get by" with a hazy, indefinite conception of those fundamentals of biology we were taught in school, but certainly not when we assume the rôle of an educator and director, if we wish to secure the proper results from our mechanical procedures. As all scientific dentistry is based upon a consideration of the biologic requirements of the cell, it follows as a matter of fact that the application of biologic principles in the practice of periodontia is not unlike that in any other branch of medicine. The fundamental life laws govern here as elsewhere in the body, and any violation of those basic health laws—proper nutrition and function—results in symptoms we call disease. We do not treat symptoms, but direct our efforts at the factor responsible for such disturbance, and Dr. Tishler has made the point well in his paper that medicaments have little if any place in the practice of periodontia. However, in directing our efforts to the culpable factor, we must at times go beyond our immediate field in order to apply a biologic principle. We go to the exodontist to have him remove a cess pool from the periodontium so that we may establish health elsewhere in our field. Also, we seek the aid of the crown and bridge operator that he may supply a physiologic requirement; in order that we may have a biologic principle applied. Nature has provided a process whereby sufficient nourishment may be maintained in the periodontium, but our usual diet is ineffective in meeting the demand for stimulation, so we supplement this with a vigorous brush massage, which is to be done by the patient, but is, nevertheless, an application of a biologic principle.

I agree with Dr. Tishler that there is no service that we render the patient worth more than giving the instruction he has outlined, for so much depends on this one thing. However, there are other cases with which we have to deal in which there is a deficiency in the general nutrition caused by improper diet, faulty digestion or various other systemic disorders; and then we must leave the field of dentistry and depend on the internist to apply a biologic principle; and a failure on our part in this handicaps or prevents entirely the hoped-for response. Dr. Tishler's paper reminds us of our responsibility to our patient. Only by correct interpretation of Nature's requirements, and the application of biologic principles in our work, can we properly control those inherent recuperative tendencies that are always present in the body ready to operate and thereby reestablish and maintain cell equilibrium. We may be sure, when we meet the conditions prescribed by Nature, the life forces respond to the extent necessary for regeneration and health that is normal for that organism.

Julian Smith, Dallas, Texas: Dr. Tishler has brought to our attention a phase of the etiology of periodontal pathology which, as he says, we are taught in college and which we immediately proceed to forget as soon as we graduate. It is impossible for anyone to absorb all the ideas advanced in this paper in one reading, and further study when it is presented in THE JOURNAL will be of great benefit to the earnest worker in periodontia. Unfortunately, as Dr. Tishler says, the biologic subjects, embryology, histology, physiology, bacteriology and pathology, are placed in the background in preference for the more material subject of constructive work, and in many instances necessarily so, for the majority of our graduates are forced to the consideration of the material side of our profession. But even so, the question of preventive dentistry might well be included in the practical application of his energy. A general idea of the fundamentals of biology materially aids him to realize that mouth hygiene is the most important factor, not only to produce a healthful systemic condition, but also to lay the foundation for successful constructive work. Dr. Tishler says, "Our study in histology teaches us that the basis of all animal life is the cell, and that of pathology shows that any alteration or change that it may undergo, directly concerns us in our treatment of diseased areas." In other words, proper cell metabolism means health, and vice versa. A most interesting study in early diagnosis of what no doubt is due to perverted cell metabolism is minutely described in Dr. Box's recent publication "Studies in Periodontal Pathology," under the heading of "Rarefying Pericementitis Fibrosa." Before any visible diagnostic symptoms appear, there is a pathologic change taking place in the pericementum, wherein is produced a new substance, which gradually penetrates the alveolar wall, causing a rarefying of adjacent bone and reducing the calcium of that structure, and thus preparing the way for a general breaking down of the periodontium when pocket for-

mation begins in the gingival crevice. This is, as I understand Dr. Box's research report, a certain form of cell metabolism, due to deficient calcium content in the cell. To quote Dr. Box accurately, he says, "This is a chronic and progressive lesion in the pericementum which results in the rarefaction and destruction of the alveolar bone. The process consists of the formation in the pericementum of a new tissue which on the one hand changes the normal arrangement of the pericemental structures, and on the other, replaces the bone substance of the alveolar process." This discovery of Dr. Box is important as it accounts for our suddenly (as we supposed) developed deep pocket, following apparently early symptoms of gingival disturbance. What Dr. Tishler has to say in regard to the possible disturbance of the internal secretory or endocrine glands, and the resultant deficiency of the lime content of the cell and its consequent influence on all body tissues, brings new thoughts in regard to the possible causes of lowered resistance that may prove valuable in correcting systemic disturbances. He mentions Mallory's classification of injurious or cell irritants into three classes, mechanical, physical and chemical. I want to stress particularly the mechanical group, and to pass lightly over the first or what we have come to believe the most important of these, not because I undervalue its evil influence, but because this subject will be presented and discussed thoroughly in a separate paper. I refer to what is characterized as traumatic occlusion. But next in importance in preventive operative work is the restoration of proper tooth form. Improper tooth form produces all forms of mechanical disturbance, even that of traumatic occlusion, the one exception being the mechanical injury produced by calcific deposits in the gingival crevice and on the cemental surface. Proper tooth form includes proper occlusion, good contact, restoration of the marginal ridge and reproduction of convex surfaces of the tooth, all together acting as a protection to the investing soft tissues. This class of restorative work is more carelessly done and its effects are more marked than any other dental service. The utmost attention to detail in restoring tooth form will go far toward obliterating one form of periodontoclasia: "man-made pyorrhea." That the use of medicines in the treatment of periodontoclasia is contraindicated is emphasized by Dr. Tishler. His quotation from Adami and McCrea describing the processes of granulation and showing how easily this delicate process can be interfered with by outside influences should be conclusive evidence against the use of any agent that could interfere with Nature's processes. I heartily agree with him in condemning the actions of newspapers and trade journals that publish and advertise medicaments for the treatment of periodontal lesions, especially such as are advocated for the use of the operator. While the home remedies are of no particular value, they do little injury. Correcting occlusion, careful curettement of root surfaces and the adjacent alveolus, not neglecting the inner lining of the gingiva, in order to remove as much as possible of the epithelium (which according to McCall does not so readily form reattachments as does connective tissue), intelligent stimulation of the capillaries by proper toothbrushing, attention to personal hygiene, dietary regulation, in fact, any process tending to build up the nutritional forces, constitute the only accepted treatment for this disease. Dr. Tishler has cautioned against permitting any scratches or grooves to remain in the root surface as a preventive of any chance of reattachment, but I want to caution you against the too vigorous use of your instruments—overinstrumentation. Instruments that can cut the surface of the root can do incalculable injury. The cementum which forms the outer surface of the root, has a dense, noncellular layer on the surface that protects the cellular cementum underneath. Dr. Box says this dense covering is in some places only the thickness of a human hair. The pericementum is attached to this dense structure, and the fibers of the pericementum penetrate the surface to a depth of one-half the thickness of a human hair. When the pericementum is destroyed, the surface of cementum is left with this pitted surface exposed, which, in order to produce a smooth polished surface, must be planed to a depth of one-half the thickness of a human hair, but no more, as the cellular structure underneath must be protected. How many of us can so gage our instrumentation as to assure this accuracy, which is essential in order to obtain a new layer of cementum and without which there can be no reattachment. Noyes, quoted by Dr. Tishler, says that "cemental surfaces which have long been bathed in pus may be so filled with toxins that no cell can lie in contact with them and perform its function." So it is necessary to

remove the pus-ladened surface of cementum, leaving, as nearly as possible, a surgically clean root. The subject of the etiology and treatment of periodontal lesions is such a large one that time forbids us to try to discuss more than one phase of it at a time. We have but barely touched the bacterial influences in the progress of disintegration, but this is as important as other influences in causing and continuing the destructive processes in periodontoclasia, although it is in the secondary class. Our efforts in the treatment of periodontal lesions are still in progressive development, and until we are able to make a differential diagnosis in the etiology of individual cases, the results obtained will be somewhat problematic.

W. H. Potter, Boston, Mass.: I believe, as Dr. Tishler does, that these tissues should be treated with kindness and tenderness. Therefore, I am also much in sympathy with the use of physiologic sodium chlorid solution for cleaning the teeth and the method of massaging the gums that accompanies its use. We need to emphasize to our patients the fact that it takes time to clean the mouth properly. From three to five minutes should be taken in order to get really satisfactory results in stimulating the mucous membrane and in removing deposits. If we can get our patients to devote twice as much time as they at present give to care of the mouth inestimable benefit will result. Let us insist that it be taken after breakfast, whatever is done before breakfast, and at night as well.

A. R. Prothro, Wichita Falls, Texas: A great many of the ills of the human race are due to the conditions we find in the mouth that have been discussed here today. How to get at these scientifically and overcome them is the point. We have been taught to believe that the disease we termed pyorrhea is due to amebae that localize in the periodontal membrane, and that by systemic treatment we can overcome it. When we remove the teeth, as a general thing, the condition clears up and good health follows. Now is it possible that we can cure pyorrhea, removing the cause and leaving the teeth in position, and still have the patient in as good condition as though the teeth were removed? Is it best to remove the teeth when we have a case of pyorrhea in an advanced stage? Or shall we try to cure the condition? Unconsciously, we have learned from experience to recognize the condition in the mouth almost as soon as the patient enters the office. You can take a person with good, sound teeth, and you find a healthy body. In a patient unduly aged, there are certain conditions that show he has some trouble somewhere; in nine cases out of ten, it may be due to the condition of his mouth. We should be more scientific. We stress the mechanical portion of our work too much and leave this scientific part without study. We do not get at the meat of the subject. We do not treat scientifically. I hope that Dr. Tishler and others will give us something through our journal which we can study, and I am sure we will all profit by it.

Harry A. Burns, Tulsa, Okla.: I wish to stress particularly Dr. Tishler's idea of the broad and fundamental biologic factors involved in our treatment of periodontoclasia, including the importance of an understanding of embryology, histology and pathology; also the importance of early treatment of these cases, so that the patient will not finally go to the general practitioner, with deeper pockets, involving extensive bone destruction, etc. It is most remarkable what can be done in these cases if they are taken early, sometimes without any instrumentation other than the use of small carborundum stones. I should like also to stress the point Dr. Tishler makes in advocating the restricted use of medicaments. There is probably no more antiseptic dressing for a pus pocket after curettement than a healthy blood clot.

L. A. Neill, El Paso, Texas: I wish to speak of Dr. Smith's statement in his discussion relative to his treatment of iodin and creosote crystals. I find in postoperative treatment that it is a very good thing to have the sensitive teeth or dentin covered over with a solution of tannic acid and glycerin. It will discolor the tooth very much, but if it is a posterior tooth, it is better to have it discolored than oversensitive. I differ with Dr. Smith a little in his statement that the home medicinal treatments do no harm. I think it is leading our patients in the wrong direction to allow them to believe that they get some benefits from medicinal home treatment. I tell them to spend that money for toothbrushes and to brush the teeth and gums properly, thus applying the biologic

principles and not depending on medicinal agents. The reason I object to the home treatment is that the patients depend more on them than on the use of the toothbrush.

L. P. Robertson, Marlin, Texas: The great tragedy, in my opinion, in the practice of dentistry today, is the sad neglect on the part of the dentists over the country, as we have been told here. There is a great field for this work, and I would urge that the general practitioners throughout the country to pay more attention to these conditions and make their study and treatment more a customary part of their practice. Until we get the profession interested along this line, we are sadly neglecting one of the most important features of our practice.

C. S. Kramer, Woodman, Colo.: Dr. Tishler brought out the point of tissue or cell resistance. The cells of one part of the body will resist certain organisms that cells differently located will not resist. For instance, gonococcus is very virulent when it enters the eye. If an organism enters the mouth and the patient has good resistance, he is able to overcome it in a short time. In another case, with the same organism, possibly the patient does not have sufficient resistance, and so he develops a deep lesion. In one of his discussions, Dr. Smith mentioned the matter of nostrums and advertisements, both in THE JOURNAL and in our exhibit hall here, as being unethical. The orthodontists have instituted a campaign for censoring our national magazine as regards orthodontic appliances. It is up to this section to institute a campaign against the many existing nostrums, including the so-called pyorrhea cures.

S. R. Parks, Dallas, Texas: Dr. Tishler is right in his statements as to the education of the people and the prevention of these diseases. How much time do our dental students get in prophylactic work in school? We spend from 75 to 80 per cent of our time in school when students on crowns and bridgework, plates, etc. Under such circumstance, when the student comes out, how can you expect him to teach the patient the prevention of these diseases? Until we settle that question in the schools, we cannot settle it outside. The research man may give us scientific papers, but the general practitioner does not follow up the information we get here. How can we teach the patient except through the general practitioner? What is Dr. Tishler's routine in diagnosis when a patient first comes in? Does he make an entire roentgen-ray examination of the mouth, impressions of the upper and lower teeth, plaster molds, etc?

Dr. Tishler (closing): Dr. Potter spoke of the length of time devoted to brushing the teeth. He said from three to five minutes is required. To brush the teeth properly takes from eight to twelve minutes. Patients come to me usually as a court of last resort, and I insist on them following my instructions absolutely. When one fails to do so, I usually have a heart to heart talk with him before he is dismissed. Dr. Prothro spoke of the ameba as the cause of periodontal disease. I think this theory has been discarded. He also asks when teeth should be removed and when retained. If the prognosis is unfavorable, teeth should be removed; otherwise, an effort should be made to save them. Box shows that regeneration of the alveolus takes place in certain instances. I have seen roentgenograms that prove this, and I do not advise the extraction of any tooth until after a certain amount of treatment is given and it is found that it does not respond favorably. An exception is made in cases of multirooted teeth when three quarters of the process is destroyed and the occlusion is such that it could not be adjusted. I usually give a thorough curettement and ignore the area treated for at least a month. Then, if it is found that the mucous membrane responds, nothing more is done. Strictly speaking, a healthy body does not always denote healthy teeth. Some people may absorb toxins and show no physical effects. They may have loose teeth with pus exuding about them, and yet be in apparently good health. As to the routine of diagnosis, I first take the case history; then chart the teeth; and note the pockets, roughly, and the areas of trauma. Then I take a roentgenographic survey of the entire mouth. This is followed by good impressions and plaster casts for the purpose of studying the occlusion. If it is a case for the internist, the patient is referred to him for a general physical examination. I also inquire into the diet. I cannot say that I have had much success with diet in people of advanced age; still, is worth while to consider and correct it if possible.

A SIMPLE PLASTIC OPERATION FOR THE RESTORATION OF THE ALVEOLUS

PRELIMINARY REPORT

By THEODOR BLUM, D.D.S., M.D., F.A.C.D., New York City

(Read before the American Society of Oral Surgeons and Exodontists, Dallas, Texas, November 6-8, 1924)

A NUMBER of operations for the restoration of the alveolus of the maxilla and mandible have been described for the purpose of making the construction of artificial dentures possible. Such restoration may be indicated in partially as well as in fully edentulous jaws. The conditions necessitating such an operation are mostly due to more or less extensive obliteration of the upper and lower buccal folds, owing to muscular and scar tissue attachment to the ridge or the buccal plate of an apparently normal alveolus, or to such attachment to a largely obliterated alveolus, or, again, they develop in those cases in which the soft tissue attachments are normal, but so much of the alveolus has been lost that they seem to leave the alveolar ridge in a practically horizontal direction.

This introduction gives the indication for an operation that will be described below. First, however, mention must be made of the anesthesia that has been employed. It would seem that local anesthesia in the form of injections either by conduction or by infiltration is indicated. No objection, however, can be raised to the use of a general anesthetic if the operator so desires and if he can perform such a delicate, but not difficult, operation under general anesthesia.

The operation consists of: the incision, the separation of the flap from the periosteum, suturing, medication and dressing.

The incision will be more or less curved, depending on the extent of the lesion, the convexity facing the alveolar ridge. It should be made through the mucous and submucous tissue down to, but not including, the periosteum.

The separation of the flap from the periosteum can be performed either with the periosteal elevator or with this instrument, the sharp point of which has been protected with gauze. The separation is continued to approximately the normal level of the upper or lower limit of the fold. Any excessive bleeding must be taken care of at this time.

The suturing is the most difficult part of the operation, an endeavor being made to unite the free edge of the flap with the deepest part of the raw surface. A well curved needle and dermal suture (fine) give satisfactory results. The needle is inserted into the free edge of the flap, entering the tissues at

the mucous surface and leaving at the raw surface. Then the deepest part of soft tissue is engaged with the needle and the suture drawn through it. In closing the suture, the free edge of the flap is pulled deep into the wound and fixed there, one side, namely, the outer, being left covered by mucous membrane, and the periosteum being exposed on the other. This adjustment of tissues will prevent reattachment. The number of sutures will depend on the length of the incision. The operator will find that the tissues at the deepest part of the wound are not only difficult to reach with the needle, but tear very easily. Therefore, it may be best at times to pull the needle entirely through the free edge of the flap first, before again engaging it in the soft tissues at the depth of the wound. An alveolotomy may be performed at the same time.

The application of 25 per cent argyrol is indicated, as well as the insertion of an iodoform gauze dressing for protection of the wound.

The postoperative treatment is simple. The dressing may not have to be replaced after being removed the first or second day after the operation. The wound can be kept clean thereafter by the use of a mouth wash or warm salt water from a rubber bulb syringe. At every visit, argyrol is applied to the region. In every other respect, general and local postoperative care does not differ from that of any other surgical case. The sutures are removed on or about the fifth day. Shortly thereafter, the raw surface of the wound will be covered by epithelium.

While this simple operation for the restoration of the alveolus is applicable in a large number of cases, it is needless to say that it cannot be employed in every instance. Only six cases of this type have been closely observed of late, no special attention having been given to this type of operation previously. However, as the results have been so gratifying and the operation is so comparatively simple, it seemed that a preliminary report should be given to the profession for trial and further report.

DISCUSSION

E. W. Browning, Salt Lake City, Utah: I think this operation should be used more extensively. In the few cases in which I have performed a similar operation, I used vulcanite base plate to hold the flap back. I believe Dr. Blum's method of suturing is much better, because, in using vulcanite, if the mouth becomes sore and the patient removes the base plate, there is apt to be a reattachment of the two raw surfaces. The operation is a commendable one and one through which we may make many dentures successful that would otherwise be failures.

E. C. Hume, Louisville, Ky.: I believe that in many instances people who are helpless with dentures as now made for them could, through this simple operation, be enabled to wear dentures and wear them effectively. Dr. Blum is right when he says that the difficult part is the suturing. I find that a very short curved needle with a sharp point is the type to be used. Some of the needles that the manufacturers put out for us have a cutting edge back just a little ways. These I have never been able to get very far with. I also believe that making two hitches of the same suture is advantageous, going through the flap first. I know that in some instances men in general practice have tried to do this work and have failed simply because they did not use the right kind of suture material and properly place the suture. As Dr. Blum says, the dermal suture is the one to be used. An ordinary catgut or chromic gut suture will be a failure.

J. A. Blue, Birmingham, Ala.: Suturing the flap to the periosteum as described by Dr. Blum is by no means easy, but if his technic is carefully carried out, excellent results may be obtained.

Another method that has proved satisfac-

tory in my hands is to follow the technic as described by Dr. Blum after the denture has been constructed, and in lieu of suturing, stick on the rim of the denture a layer of guttapercha, thick enough to produce a slight pressure on these parts. This is worn while granulation is taking place. It is surprising how comfortable the patients are and how rapidly granulation takes place under the guttapercha.

W. B. Amy, Toronto, Canada: In a number of cases that I have had, I have used a strip of rubber dam and simply attached it at the end. This worked very well. Cut it the desired shape, put it in lengthwise and attach it to the tissues by suture at the other end, keeping it washed out.

H. A. Elmquist, Des Moines, Iowa: Does this operation cover the type of cases in which we find several ridges or folds of scar tissue? Should one include all of this mass of scar tissue in the flap? My practice has been to remove as much of it as in my judgment could be removed, and then secure the remaining tissue in a way that would assure a ridge. I remember one case in which there was a mass of scar tissue composed of five or six ridges, the mass being as long and thick as the index finger. I could see no other way of dealing with it except removal. The muscle attachment I have found an easy problem as compared with that of the excess tissue.

Dr. Blum (closing): Many operations have been devised to overcome this muscular and scar tissue attachment to the ridge which prevented the proper fitting of vulcanite plates. One way of dealing with this was the process mentioned by Dr. Browning. That I think was described during the war by Pickerill of New Zealand. He simply incised and used a vulcanite plate, which was placed in position, and at times prevented the reattachment. Not much consideration was given to the feelings of the patient, and naturally under those circumstances one can do almost anything. But in the practice that one has to handle during peace times, a patient is at liberty to find an operator who will do the work just as efficiently with less pain. I will also answer Dr. Amy and say that, in this respect, if someone can show the ability to suture these tissues to a piece of rubber dam, he may as well do the simple thing and suture as I have shown. Another mode of operation was the epithelial inlay, for the same purpose. It is certainly a complex way of dealing with these conditions, but may be used in rare instances. As I have said, we can't always use this simple way in dealing with more complex conditions. Dr. Hume is quite correct in saying that in a large number of cases one will have to suture in two stages. In other words, he will have to engage the mucous and submucous tissues first and pull the needle through, then turn to the soft tissues of the wound and engage the tissues again. Another good way of dealing with this problem is to use two needles on one thread as Lane and other men advise in cleft palate operations. Then one can go into the mucous and submucous flap, beginning at the raw surface and coming out at the mucous membrane and then go in the regular way into the other tissues with the second needle and suture. The objection to Dr. Blue's method is the fact that one has to depend again on the prosthodontist, and it is again a question of hurting the patient more than is probably necessary. Dr. Elmquist asked whether this operation can also be employed in a case of scar tissue formation. We do use it in those cases. Naturally, when the scar tissue is too extensive, it has to be removed. So far, I have been able to get along with this simple operation without any inlays or any other help.

OSSEOUS TROPHIC CHANGES IN THE JAWS AND PALATE IN THE TUBERCULOUS

By C. S. KRAMER, D.D.S., Woodman, Colorado

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

SINCE tuberculosis is so widespread and so little has been written about it from the standpoint of the mouth in comparison with that of other parts of the body, this paper will cover some manifestations of the disease in the mouth. Every student of public health problems should know as much as possible about tuberculosis, which afflicts nine-tenths of the human race during the span of life, according to accurate pathologic statistics. The tubercle bacillus is no respecter of race, creed or social standing, and according to reliable investigation, one person in every ten has the disease in an active or a progressive form. As it may affect almost any organ of the human body, it must interest any profession dealing with human ailments.

Before the discovery of the tubercle bacillus by Koch in 1882, the medical world was divided in their opinion as to the etiology of the disease; some believing it to be infectious, as is syphilis, and some maintaining it was due to a specific or nonspecific body cell of unknown origin, similar to cancer.

Koch was able, by a special staining method, to demonstrate the tubercle bacillus in the diseased tissue, to culture the organism outside the body and, by inoculating susceptible animals such as guinea-pigs and rabbits, produce the disease and again recover the germ from these animals. (Figs. 1-3.)

Let us consider for a moment the direct or primary changes that this disease produces in man. Since pulmonary tuberculosis is the most common form of the disease and since the basic tissue changes produced directly by the bacillus in affecting the various organs or tissues of the body are very much alike, a brief review of the changes undergone in the lungs of the tuberculous will be of value in considering tuberculosis in general.

Pulmonary tuberculosis as a disease entity has been known for many years. It was even recognized by Hippocrates. But an accurate description of consumption or pulmonary tuberculosis was not given until the seventeenth century, when Sylvius, Morton, Baillie and Bayle contributed to our present gross pathologic conception of this disease. These descriptions laid the foundation of our finer methods of diagnosis of the disease in man, which were developed by Leopold Auenbrugger and Rene Laennec at the end of the eighteenth and beginning of the nineteenth century.

These men also gave us our conception of the unity of tuberculosis no matter where it occurred in the body. Tuberculosis of the nose, mouth, liver,

lungs and other organs was in all cases basically tuberculosis; whereas, prior to this time, tuberculosis of the nose and face was called lupus, tuberculosis of the lymph glands, scrofula; tuberculosis of the lungs, phthisis, consumption or *Lungen Schwindsucht.* There existed almost as many names for the various tuberculous afflictions as there were organs in the human body. To comprehend fully what the tubercle bacillus does to the body, we must resort to a method of analysis such as was used by the pioneers in this field of study and resembling the method used by the chemist in his determination of the formula of a substance of unknown composition. This method of analysis has revealed that the anatomic unit of tuberculosis is the miliary tubercle, from which develop all the tuberculous changes that we find in the lung in pulmonary tuberculosis. Thus, we find, as the basis of the developmental stage, the miliary tubercle, the large tuberculous nodule with a caseous or cheesy, necrotic center and peripheral scar tissue capsule, and the calcified or healed nodule with lime deposits in the center. With these essential constituents of cellular morphology in mind, we will be able to comprehend more fully the pictures of tuberculous lungs to be shown, which illustrate the changes and destruction caused by the tubercle bacillus. When destruction is predominant, ulcers or cavities form, and these differ little, basically, whether they occur in the lungs or elsewhere in the body, as for instance in the mouth.

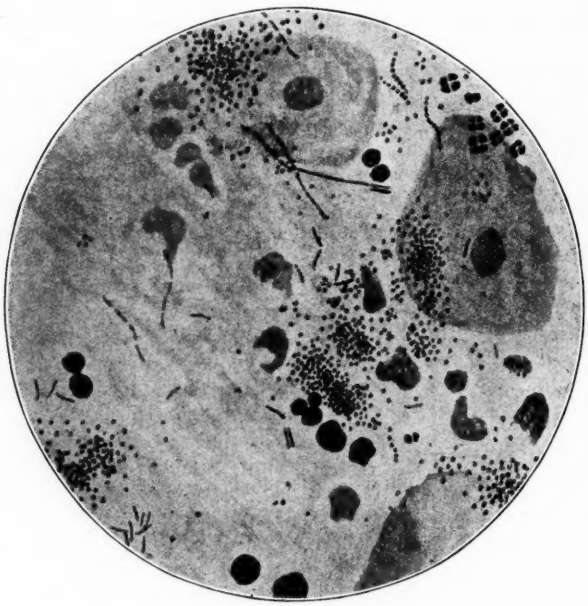

Fig. 1.—Tubercle bacilli in mouth smear. The conglomerate mouth flora may be noted.

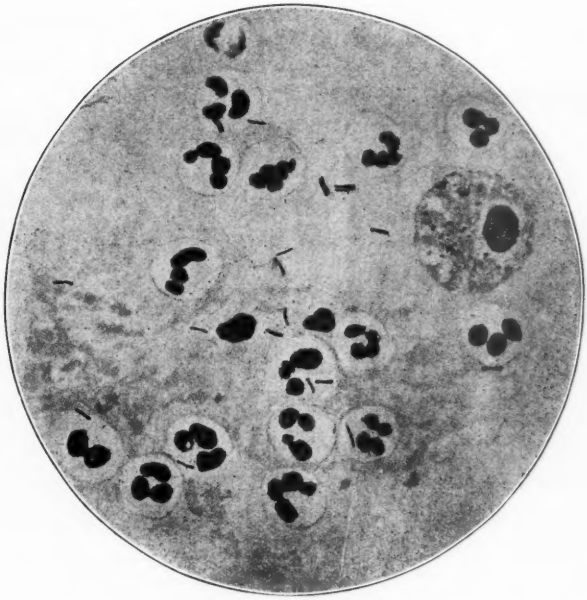

Fig. 2.—Smear from lung sputum. The absence of other bacteria may be noted.

The changes occurring in the lungs as a result of the invasion of tubercle bacilli are shown in Figures 4-7. The changes produced in the mouth when the tubercle bacillus makes it a point of attack are illustrated by Figures 8-13.

Thus far, we have considered the primary or immediate effect of the tubercle bacilli, but in tuberculosis, especially of the pulmonary variety, the patient suffers changes in the entire body, which can be attributed not to the direct attack of the bacillus but to its indirect action by means of certain toxic substances produced during the course of the invasion. One of these changes is hypertrophic osteo-arthropathy, which was first described in 1890, by Bamberge and Marie, who did not at that time realize that this condition was especially common among the tuberculous, since they first studied it in other diseases. For many years, club fingers and hypertrophic osteo-arthropathy were

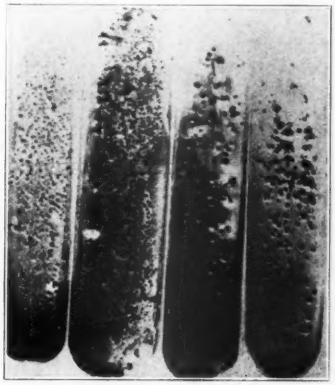

Fig. 3.—Cultures of tubercle bacilli.

considered as unrelated, but, in 1903, Theodore Janeway suggested that the

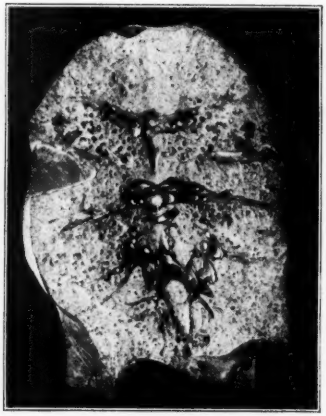

Fig. 4.—Miliary tuberculosis. Tubercles are scattered through the lung.

Hippocratic fingers and the bone changes of hypertrophic osteo-arthropathy were

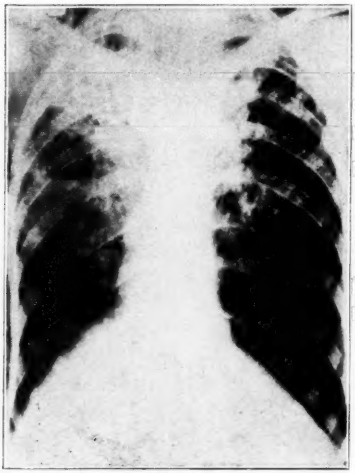

Fig. 5.—Appearance of chest of patient with tuberculosis, showing cavity above at left.

only different stages of the same process. Locke of Boston, in 1915, demonstrated clearly that simple clubbing of the

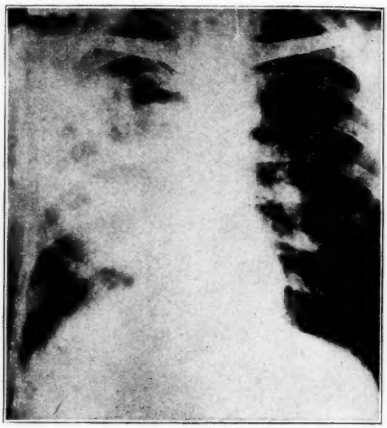

Fig. 6.—Appearance of chest in case of pneumonia, in which the active germs are Vincent's organisms.

Fig. 7.—Same case as that shown in Figure 6, which came to postmortem. The thickened bronchi and hemorrhagic areas may be noted through the remainder of the lung.

fingers and hypertrophic osteo-arthropathy were identical, the former repre-

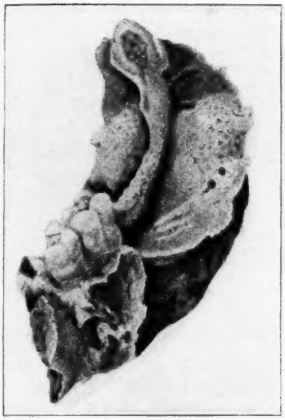

Fig. 8.—Tuberculosis of mandible.

senting only an early stage of the latter.

In 1917, Leo Kissel, of New York, made a study of this condition in the tuberculous in the second and third stages. He concluded that hypertrophic osteo-arthropathy is present more frequently in pulmonary tuberculosis than

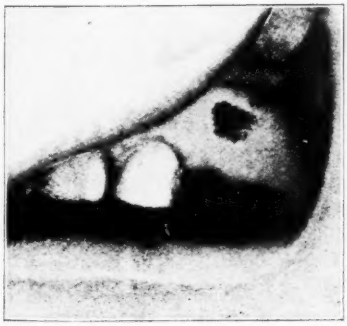

Fig. 9.—Tuberculous ulcer of the gum at a point distant from any possible source of local irritation.

the usual clinical examination would permit us to believe. Our own studies on the patients of the Modern Woodmen of America Sanatorium and those

Fig. 10.—Tuberculous ulcer of soft palate.

of H. J. Corper of the National Jewish Hospital for Consumptives in Denver entirely corroborate the studies of Kissel, indicating that the condition, though irregular in its localization, is systemic, affecting almost any of the bones of the body, but in the majority of the cases having certain sites of predilection. The manner in which this condition expresses itself in the tissues is shown in Figures 14-17.

Now that we have seen the distant or systemic changes produced by pulmo-

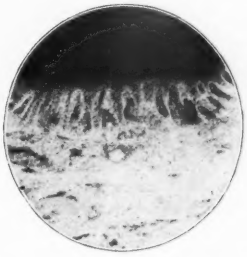

Fig. 11.—Tubercle in epithelial tissue. The scar tissue capsule with tendency to cavitied tissue from the gum margin may be noted.

nary tuberculosis, let us consider these from the standpoint of the dentist. Unfortunately, careful studies of the teeth, gums and bony structures of the mouth in the tuberculous, especially those pertaining to the secondary effects of tuberculosis, were not available to me in the literature, but through the cooperation of Dr. William M. Gilmore, resident dentist of the National Jewish Hospital for Consumptives, and Dr. Corper, I was able to obtain some data on this point as observed in patients. Changes in the soft and bony tissues of the mouth are difficult of interpretation, but the data obtained seems conclusive in indicating some facts of value.

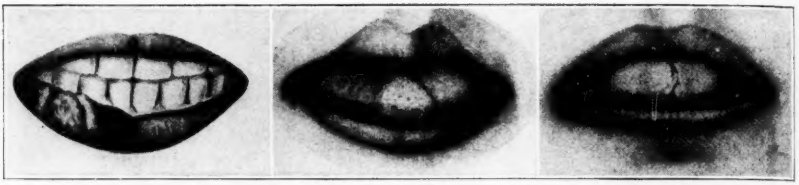

Fig. 12.—Left: Tuberculous ulcer of the lip. The undermined edges may be noted. Center and right: Tuberculosis of the tongue.

When we see bony enlargements in a mouth, especially if accompanied by paleness of the gums and mucous membranes, we may be fairly sure there is or has been some disturbance of the respiratory or circulatory systems.

We have seen dentures displaced by this condition, and it often makes the proper fitting of them difficult. When the alveolar ridges are much thickened, extractions are made more difficult, and the thickening of alveolar ridges caused by this condition may be mistaken by the periodontist for hypertrophy caused by trauma or other irritation.

The evidence is overwhelming that hypertrophic osteo-arthropathy is always a secondary disease. Among the primary diseases pulmonary tuberculosis is probably the most important, though rarely inducing the extreme degree of

Fig. 13.—Left and right: Appearance of patient with tuberculosis of the skin (lupus) of nose and ear. Center: Appearance after nine months' treatment with roentgen ray, ultraviolet ray and direct sunlight.

bone and joint changes seen with bronchiectasis. There is a definite connection between the characteristic clinical course of the disease and the process in the bones. During periods of exacerbation in the primary disease, the pain, tenderness and swelling of the soft parts are not only increased, but the process in the bones is also more active. On the other hand, during the quiescent periods associated with cure or relief of the condition responsible for the bone and joint changes, the process in the bones is stationary, and, in rare instances, actual resorption takes place.

It is seen from these figures and studies that whenever tuberculosis has existed for any length of time in the body, the gums and bony parts of the jaws are liable to suffer certain changes common to hypertrophic osteo-arthropathy elsewhere in the body. The variability of location of this condition is also seen in its effect on the parts interesting to the dentist.

Therre[1], of Lyons, in 1912, noted that there was a relation between the dental system and tuberculosis anywhere else in the body, but he failed in understanding the basic cause for this,

Fig. 14.—Parrot beak nails or simple clubbing of the fingers.

HYPERTROPHIC OSTEO-ARTHROPATHY IN ORAL TISSUES IN CASES OF PULMONARY TUBERCULOSIS

Condition	No. of Cases	Gums	Bony Processes of Jaws	Hard Palate
Normal	25	0	0	2
Early	22	0	4	8
Moderately Advanced	50	9	12	24
Far Advanced	100	12	36	65

using vague terms in an attempt to describe the condition. He must be given credit for having noticed the objective symptoms, but he erred in thinking that they were to be explained on the same basis as the metastatic joint involvements in tuberculosis. From the standpoint of dental hygiene in the prophylaxis of dental tuberculosis, there can be no question that, especially in the patient who has an open pulmonary tuberculosis with tubercle bacilli in the

1. Therre, M. C.: Gaz. d. hop., 85: 1451-1454, 1912.

sputum, every precaution should be taken to avoid points such as carious teeth and open wounds, where these bacilli may lodge and proliferate, starting new points of disease.

Partsch,[2] of the Zahnarztlichen Institute der Universitat, in Breslau, in 1904, goes so far as to maintain that a carious tooth may be the point of entrance of primary tuberculosis, and he

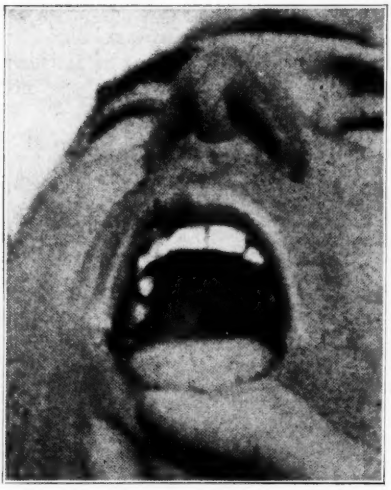

Fig. 15.—Nodules in palate.

cites a case in a girl, 14 years of age, in which a carious lower molar tooth led to tuberculosis of the submental and submaxillary glands with coincident tuberculous periodontitis.

We[3] have been able to demonstrate tubercle bacilli in the mouths of 24 per cent of all patients with a positive sputum. In this work, we first made smears direct from the mouths of patients showing a positive sputum, and only in rare instances were we able to find the bacillus, but on animal inocula-

Fig. 16.—Model showing nodules in palate (gross enlargement).

tion, we were, as before stated, able to demonstrate the organism in 24 per cent of all cases showing positive sputum.

We have made many mouth inoculations in laboratory animals, both in gingival tissue and through the pulps of teeth and always produced tuberculosis in these animals. I have shown these

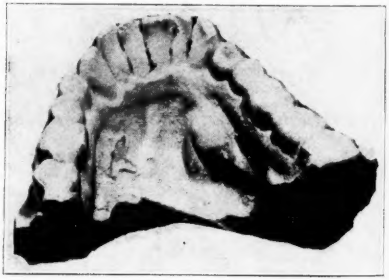

Fig. 17.—Model showing nodule on lingual surface of mandible.

animals at many meetings, always with the object of emphasizing that, since the tubercle bacillus is heavier than air and always settles to the floor or ground, and since our children are prone to play

2. Partsch: Deutsch. med. Wchnschr., 30: 1428-1431, 1904.

3. Kramer, C. S., and Downing, E. D.: Possibility and Probability of Tuberculous Infection Through Gingival Lesions, Dent. Items of Int., 43: 80-85, 1921.

on the floors and put everything that they can into their mouths, if they should have an open lesion through teeth or mucous membranes, this would be a probable point of entry for the bacillus.

Georges Petit,[4] in 1910, as a result of the examination of sixty-three cases of pulmonary tuberculosis in children ranging from 5 to 16 years of age, comes to the conclusion that dental lesions are very common in these children, even to the extent that they may be regarded as presumptive evidence of an early tuberculosis.

Since the dentist is, in many cases, the first to notice diseases of the mouth, such as cancer, syphilis and tuberculosis, he can frequently save a patient a great deal of future discomfort by carefully watching for any pathologic changes and referring the patient to a physician for early and appropriate treatment.

Frederick B. Moorehead,[5] of Chicago, has called attention to the lack of scientific study of the mouth. He says: "Although mechanical dentistry has made splendid progress and has contributed in splendid fashion to the weal of society, nevertheless the most serious question which the mouth specialist faces is that of disease, its recognition and treatment. Diseased conditions of the mouth must always be studied and interpreted in their relation to the whole organism." He points out the important relations between carious teeth, especially in children, and lymphatic tuberculosis of the neck and chest glands, and, emphasizes dental hygiene as a preventive; which is also further stressed by Eugene S. Talbot in his discussion of Dr. Moorehead's paper.

George Thompson,[6] honorary dental surgeon to the Royal Hospital for diseases of the chest, in London, in a paper read in 1911, lays great stress on diseased conditions of the teeth and gums as a predisposing cause of tuberculosis and a marked hindrance to a permanent cure of pulmonary tuberculosis. He cites Pawlow's experiments in indicating that it is not the amount of food nor its quality that nourishes the patient so much as the influences that determine the condition of the nervous system and so affect digestion, and it is in the act of eating that the whole mechanism of digestion is set in motion. "An efficient stomach is the greatest asset of the consumptive." The first 3 inches of the alimentary tract is under the control of the patient himself, and if the oral cavity is septic, how is it possible to expect the remainder of the tract to perform its functions in a healthy manner? A septic oral condition means pollution of the stream at its source.

More than 50 per cent of the patients entering the sanatorium have carious teeth, according to English's statistics. He also calls attention to the importance of the normal occlusion of the teeth, deviations from which result in defective breathing and malnutrition. In connection with the latter, I may say that 10 per cent of our patients, all adults, have one or more unerupted teeth. In conversation with Dr. Gardner of the Mayo Clinic, I was told that their mouth examinations reveal only 3 or 4 per cent. My idea is that, in these cases with constricted arches, we have a similar constriction of the upper respiratory tract, with a predisposition to upper and lower respiratory disease.

4. Petit, Georges: Rev. tuberculose, 18: 85-88, 1910.

5. Moorehead, F. B.: J.A.M.A., 55: 495-497, 1910.

6. Thompson, George: Brit. J. Tuberculosis, 5: 304-306, 1911.

In a paper read before the British Odontological Society, F. Lawson Dodd[7] repeats the aphorism "Look after the two ends of the alimentary canal and the middle will look after itself." Oral sepsis, he believes, is to blame for improper diet, mouth breathing and enlargement of the tonsils, which lead to malnutrition and its consequent tuberculosis. In combating anorexia, attention to the teeth and mouth is, according to Dodd, all important. A septic mouth condition, with coated tongue, local suppuration of the gums and suppurative periodontitis all destroy the desire for food by their effect on the mucous membrane of the tongue and fauces, chiefly by impairing taste. He does not call attention to the systemic or general effect of these toxic foci, and also overlooks the importance of these conditions; that is, diseases of teeth and tonsils, in the production of metastatic disease, such as gastric ulcers and heart disease, as has been shown by E. C. Rosenow and others. However, he believes it a waste of money to insist on purer and controlled food supplies without at the same time considering oral cleanliness.

CONCLUSION AND SUMMARY

The dentist can be of aid to the consumptive whether he is resident in a sanatorium or not.

1. He can play an important part in preventing tuberculosis both in children and in adults. (a) by spreading the lesson of dental hygiene and good health and nutrition; (b) by proper replacement of teeth to assure proper occlusion, so important in maintaining good nutritional conditions; (c) by preventing oral sepsis or checking it when resulting from poor conditions of the teeth or gums, and when due to conditions of other tissues of the mouth, i. e. tonsils, etc., by referring the patient for proper medical treatment or advice.

2. (a) If the dentist, on noting any of the earmarks of tuberculosis in a patient seeking dental treatment, will refer the patient for appropriate and early treatment of his basic condition, the disastrous results of this disease may be prevented, and thus total incapacitation, so frequently noted in the late stages of tuberculosis, be avoided. (b) By careful attention to every detail of dental treatment with a view to complete and efficient function of the mouth and teeth, the tuberculous patient may be restored to a good nutritional condition, from which a favorable outcome of the treatment of the patient's basic disease may ensue.

3. By careful observation of the patient in the advanced stages of pulmonary tuberculosis for any possible focus in the mouth in which the tubercle bacillus may gain a foothold, or for the early secondary mouth lesions produced by the tubercle bacillus, local treatment may be instituted early enough to avoid the development of the painful ulcerating stages of this disease.

May I again urge the closest cooperation between the dentist and the physician in all their efforts to prevent tuberculosis in those not afflicted and in arresting the disease once it has established itself?

DISCUSSION

R. D. Griffis, Paris, Texas: In the twenty-five nontuberculous cases, what was the average age? In tuberculous cases I have noticed that hyperemia of the gums seems common, and in my experience the condition has not responded to treatment.

7. Dodd, F. L.: Tr. Odontol. Soc., 38: 260-282, 1905-1906.

Benjamin Tishler, Boston, Mass.: Does anemia of the soft tissues persist after the disease has been allayed?

F. C. Montgomery, Heber, Utah: I should like to ask Dr. Kramer the procedure he would outline in restoring the case with the large nodule which he showed. Would it require surgical removal?

Olin Kirkland, Montgomery, Ala.: Are the nodules attributable to tuberculous infection, or are they among the symptoms of tuberculosis?

Dr. Kramer: Replying to Dr. Griffis' question, the twenty-five non-tuberculous patients were laborers around our institution, averaging in age from 20 to 45 years. They all were engaged in outside employment. As to hyperemia that does not respond to treatment: any active progressive case of pulmonary tuberculosis, as far as I know, with any other disease superimposed, will not yield readily to treatment. If the patient's general condition improves, we can then expect improvement in other lesions, and if tuberculous infection is present in the lungs, it is difficult to get healing in other parts of the body as we might naturally suppose. Dr. Tishler asked about anemia of these nodules. The condition was pointed out many years ago, being described as a circumscribed area of anemia of the palate and was called ischemia. But the term anemia comprehends more than an actual anemia in many cases. This anemia ordinarily clears up after the disease has been conquered. The red count of the blood may not be reduced so much, but the hemoglobin in many cases may be quite a little lower.

Dr. Tishler: Fifteen years ago, I had the symptoms of tuberculosis. I was absent from my office fourteen months, going to Saranac Lake. The physicians there found my mucous membrane pale, even after the tuberculosis was conquered. I have been working fourteen years since. The anemia of the gums has persisted.

Dr. Kramer (closing): That is remarkable. I see many patients with pale, anemic mucous membranes, and they do not as a rule, do well.

Replying to Dr. Montgomery, we construct dentures for a case such as the one you speak of, and we have had a number of them. If the tuberculosis is progressive, and the formation of the bone is going on, it is worse than useless to do anything. If the patient is getting better or the condition is stationary, surgery is indicated. In the many cases we have had there has been no recurrence. Dr. Kirkland asked if all these nodules are from tuberculosis. They are not. Some are from congenital deformity; others are from lung and other circulatory diseases. We do not get the gross nodules and growths from tuberculosis that we get from bronchiectasis and lung abscesses, but we see them often in tuberculosis, probably because of destruction of air spaces in the lungs.

PREVENTING GINGIVAL IRRITATION IN PARTIAL DENTURE CONSTRUCTION

By CHARLES A. FURROW, D.D.S., Tulsa, Oklahoma

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

IN presenting the subject of preventing gingival irritation in partial denture construction, I am not unmindful of the many factors contributing to this condition, or how important it is, especially in large restorations, to survey and visualize each case, taking cognizance of all conditions to be met.

Let us accept the scientific truths that are given us in works on histology and physiology and use these as a basis upon which to build our reason rather than the fine spun theory of some enthusiastic individual who takes only those things that assist him in proving the merits of his method. The question of methods, important in their place, are not so important as the primary question of the fundamental principles involved.

Surely, this section can accomplish much in the way of working out principles that will give us a basis upon which to work out scientific methods in this most important field of dentistry.

If we are to give earnest consideration to problems involved in partial denture prosthesis, we must be broadminded enough to give and take, to surrender principles if shown a better method. There must be cooperation from each of us, to the extent of our making a sacrifice of some pet theory, technic or instrument, if we are shown a better way.

The application of porcelain in partial denture construction may be a new thought to some of you. As you know, porcelain is the most cleanly substance we can use for restorative purposes. I could not come before you and say this is the way to relieve gingival irritation, adjacent to attachment teeth. Literally speaking, we must not lose sight of the greatest menace in successful partial restoration, which is leverage.

From a physical point of view, it must be acknowledged that a very large proportion of all failures have resulted from imposing undue and unnatural stress on supporting or attachment teeth. We must eliminate these conditions or contributing factors or reduce them to a minimum.

Let us take for granted that we have complied with all the requirements in the construction of a given case. Has your work been entirely satisfactory from the standpoint of the health of the tissues adjacent to attachment teeth, with irritation always present in greater or less degree, regardless of the fact that construction may be of gold and porcelain with teeth attached with soldered dowels, gold and vulcanite or vulcanite alone?

The case has been constructed with the protection of the gingival margin

with proper contact, tooth form, attachment impingement and saddle impingement in mind; and still we have gingival irritation.

The tissue adjacent to the attachment tooth or teeth and the interdental space seemingly is a very acceptable place for mucin plaques to form, creating a stagnant area; the materials, gold and vulcanite seemingly having an attraction for mucin plaques.

Highly glazed porcelain coming in contact with tissue and adjacent to attachment teeth does not irritate or strangulate tissue if properly adapted. We know bacteria will not attach to its surface, at least not to the same degree as to metal and vulcanite appliances. The use of porcelain, adjacent to attachment teeth, eliminates stagnant areas and permits the free flow of saliva between the interapproximal spaces.

To the man who wishes to take the road of least resistance, this will not be of interest. No doubt, most of us can recall many partial dentures we have seen, and a few we have placed in the mouths of patients have been far from satisfactory.

The easy road, the road we can construct with the least effort and trouble, as a rule leads to many mouth ills, and, in most cases, we adjust our patient to our appliance instead of adjusting our appliance to the patient.

Porcelain is one of the most fascinating of all materials we use in dentistry. The handling of it should be a part of every man's practice, and like every successful procedure, it requires attention to detail. The same amount of time you give to perfecting an inlay technic will give you most gratifying results with porcelain.

The application of porcelain in partial denture prosthesis has proved, in my hands, that we can eliminate the irritation caused by gold and vulcanite adjacent to attachment teeth.

DEPARTMENT OF DENTAL HEALTH EDUCATION

RESULT OF A SEVENTEEN YEAR EXPERIMENT IN DIET AND HYGIENE IN A CHILDREN'S HOME

By TRIM HOUSTON, Corsicana, Texas

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

THE term experiment might well be "experience;" for this is the recital of an experience, and not a scientific treatise.

In 1907, the inmates of a children's home were placed in my care. There has been no interference by anyone, but rather the most ready assistance on the part of all, from physician down. The home is about 3 miles from town, on a 160-acre tract with plenty of room for all kinds of sports, which are decidedly encouraged; with a lake for warm weather swimming and natatorium and gymnasium for winter use. The children have plenty of plain food, though they have little meat and about one-third the usual amount of sugar. They get nothing between meals, except that the smaller children have a light lunch of bread-and-butter at 3:30 in the afternoon. We are not food faddists in any sense; but if the physician feels that any child needs a certain diet, he orders it. There is no nearby store for the children to run to for any and all kinds of sweet things to eat and drink, whenever they have the money; the inclination is with them, always, of course.

The children are not of what we call the pauper class, but are from the homes of those in needy circumstances. The father must have left an estate of less than $2,000 for his children to be entitled to the benefits of the home. They come from the farm, skilled labor and smaller merchant class. The father, and often the mother, having died before the natural time, we expect the child to inherit a constitution somewhat below normal; and we usually find this to be true. Reliable family histories are seldom obtained; but those obtainable show a high percentage of chronic interstitial nephritis and tuberculosis and some show syphilis. In a great many cases in which we can get no information, comparison with those of whom we can get a clear cut history permits us to draw fairly accurate conclusions.

The children are admitted up to the sixteenth year. They are carefully examined by the physician, nurse and myself, and all discoverable defects are noted and efforts made to correct these.

After a child's mouth is put in order, it is seen once a year, or as much oftener as indications warrant. The child is given a toothbrush, and unflagging efforts are made to see that

this is used three times daily. No dentifrice is furnished, on my orders.

Mouths are examined at the home, children needing attention being sent in to the office. Since they can be seen at any time thought best, there is practically never a necessity for any severe punishment. When I find any trouble, the patient is highly pleased; for he knows that on at least one Saturday afternoon during that month he will be coming in to town, and he is perfectly willing to stand whatever may be necessary in order to have the pleasure of the outing.

Although a record is kept of all work done, no note is made here of trouble due to accident. We have had one fracture of the mandible and a number of broken teeth. Neither is the removal of temporary teeth nor prophylactic treatments recorded. About 10 per cent of the children go through the home without needing even prophylaxis. About 20 per cent need only prophylaxis. No use is made of the records of those in the home now, about 350.

At irregular intervals, we had outbreaks of Vincent's infection, until, about three years ago, we found two chronic cases, or carriers. One was the invalid mother of two of the boys who had it in an acute form at that time; the other, a 16 year old girl, who had pellagra. After the clearing up of these two cases, we have had no further outbreaks.

As for orthodontia, there is practically no call for it in children who come to the home before they are 6 or 7 years old and very few cases among the other children. The majority of cases seen are in those known or suspected of being syphilitic, and are due to nondevelopment of the premaxillary bone.

Pyorrhea we have mainly in those of known or suspected chronic interstitial nephritis or congenital syphilis, or both. In the tuberculosis families, there seems to be a more marked lack of vitality to the gum and bone, with a tendency to a recession even when there is no diseased condition present.

Decay, there can be no question, has been by far more frequent and harder to control in the mouths of the tuberculous and the syphilitic. The general shape of the teeth is not so good, the cusps neither well nor uniformly developed, with the enamel rods in the sulci either defective or, in some cases, practically wanting altogether.

Mottled teeth we have occasionally, invariably from a locality where a deep well water is used, the child who has lived there during its infancy being affected. The children born before the parents moved into that locality escape or only their bicuspids and second and third molars are affected. Those born after the parents leave the locality escape altogether.

No record is made of those who stayed in the home less than two years, as I am not so much interested in showing what has been done as in what has not been needed after a mouth condition has been gotten thoroughly under control.

We estimate that it takes about two years to bring a child up to his best; which includes getting the kidneys in good condition, clearing up any traces of syphilis and healing all tuberculous lesions; extracting all the old temporary and the permanent teeth past redemption, seeing to the tonsil, adenoid and mastoid condition, and eradicating all decay of the teeth, the re-

sult of bad dietary habits, as well as of the aftereffects of "chill" tonics that the child may have taken. In short, it takes about that length of time to put him thoroughly on his feet.

There is no trouble in getting the girls to care for their teeth; but with the average boy, there is a continual warfare until he is about 15. Yet there is not the difference in the amount of decay present in the teeth of the girls and those of the boys that we would expect.

The record of the work done during the first two years is given to show the contrast between the attention needed during this period and that needed after this two year period, meaning anywhere from the second to the seventeenth year. Of the 610 who came, 102 stayed less than two years, leaving 508 remaining more than two years; that is from two to seventeen years.

The 508 needed, in the first two years, 397 fillings in the permanent teeth; of these, occlusal cavities numbered 259; approximal, 98; buccal, 36; labial, 1; lingual, 3. The number of fillings needed after two years, that is, the period of from two to seventeen years after coming in, was 345; occlusal, 261; approximal, 45; buccal, 27; labial, 2; lingual, 10.

Table 1 gives details as to the particular teeth affected during the first two years.

Table 2 gives the data for the remainder of the seventeen-year period.

During the first two years the number of fillings in the upper first molars was 96; in all other uppers, 107; lower first molars, 155; all other lowers, 11; upper and lower first molars, 251; in all others, 145.

TABLE 1.—DATA FOR FIRST TWO YEARS*

Teeth Affected	No. of Fillings Upper	Lower
Right third molars	0	0
Right second molars	10	13
Right first molars	50	80
Right 2nd bicuspid	6	0
Right 1st bicuspid	6	1
Right cuspid	0	0
Right lateral	10	0
Right central	20	0
Left central	15	0
Left lateral	8	0
Left cuspid	0	0
Left 1st bicuspid	6	0
Left 2nd bicuspid	9	2
Left first molar	40	75
Left second molar	10	24
Left third molar	1	1

*Nerves destroyed, 31.

TABLE 2.—DATA FOR REMAINDER OF SEVENTEEN-YEAR PERIOD

Teeth affected	No. of Fillings Upper	Lower
Right third molars	3	3
Right second molars	4	42
Right first molars	42	65
Right 2nd bicuspid	3	2
Right 1st bicuspid	1	0
Right cuspids	0	0
Right lateral	3	0
Right central	3	0
Left central	3	0
Left lateral	2	0
Left cuspids	1	0
Left 1st bicuspid	6	1
Left 2nd bicuspid	3	4
Left first molar	34	63
Left second molar	9	47
Left third molar	0	1

In the period after the first two years, the number of fillings in upper first molars was 76; all other uppers, 41; lower first molars, 128; all other lowers, 100; upper and lower first molars, 204; all others, 141.

In this period, as will be seen, we have a rise in the number of lowers aside from the first molar, which is accounted for by the fact, especially,

that the second lower molar jumps from twenty-four to forty-seven.

The first molars are the chief trouble makers; the lowers leading the list, with the left leading the right, the upper first molars coming next, the left again leading the right. Next to these come the lower second molars, the left, by far, leading the right.

During this time, eight nerves were destroyed, while three permanent teeth were extracted.

DISCUSSION

Willis A. Coston, Kansas City, Mo.: When I first heard about Dr. Houston's work, I could hardly believe his statements, but I have learned to have a great deal of respect for his work. To me it is a marvelous thing. We must all believe that nutrition or lack of nutrition is the most potent factor in health or disease. In all animal husbandry, weak and undersized animals are definitely known to be the product of improper and inefficient diet. So man is but the reflection of the food he eats. Insufficient, poorly cooked food and a diet lacking wholesome nourishment produces an inefficient, poorly developed individual lacking in vigor and energy to compete fairly in the battle of life. These facts have been known and quite generally accepted, resulting in greater interest in diet as applied to physical development than ever before. To our profession has come in recent years a somewhat faint indication that this same matter of diet is the vital element in tooth development and decay. Many have contended for years that the consumption of refined foods, such as white flour and sugar, which dietitians call demineralized and degerminated food, and excessive amounts of meats and highly seasoned foods generally are the primary cause of dental caries. This contention or theory is endorsed in the findings that Dr. Houston has set forth in his paper. To those who know the percentage of dental caries throughout the schools of this country, it is startling and almost unbelievable to learn of the small, really negligible, percentage existing in this children's home. This is even of greater weight when we consider the fact that these are not picked children, from the fitter families of the nation, but, in the vast majority of cases, come from homes that are below the average in physical and mental training. Most amazing of all is the statement that the lives of these children differ not at all from the lives of all American youngsters except that they have a regimen of regular habits, good sleeping quarters and plenty of room for play and exercise, and that they have only plain, everyday food, which we may interpret to mean whole wheat bread, plenty of vegetables and fruits, with very little meat and only about 30 pounds of sugar per capita per annum. The average consumption of sugar per capita in the United States last year was 108 pounds. Is this not proof beyond question that dental caries is the result of the habits and diet of civilization? Such statements make us wonder if we, as dentists, have fully realized the great duty that lies before us. If this be true, with us rests the responsibility of preaching the gospel of diet and dental caries. Through us alone can the people be educated and instructed as to the relationship between improper diet and tooth destruction. How imperative, then, that we inform ourselves more completely in this regard, gaining all possible knowledge pertaining to the subject, then preaching it untiringly and unfalteringly. In the light of the findings of Dr. Houston, are we not convinced that this is our first and highest duty? Are we not responsible for those who entrust the mouths of their families to us? Progress will be slow, results negligible and the despair will often leer at us from around the corner. But with the convincing evidence that Dr. Houston has brought to us today, can we stand on a middle ground of indifference? Can we be true to our profession and evade an issue so vital?

Thaddeus Hyatt, New York City: In all discussion of nutrition and the proper foods to be eaten, we must remember that the only thing food will do for teeth already erupted is to maintain and keep up the health and vital resistance of the body. When the vital resistance of the body is lowered, certain parts of the teeth become more susceptible to decay. We should realize that there are 22,000 first and second permanent molars and second bicuspids coming into the mouth every hour of every day in the year, or more than 366 every minute. Nutrition cannot alter or change the shape and form of these erupting teeth. In the figures given by the essayist, there were 259 occlusal fillings, ninety-eight

fillings divided between the mesial and distal surfaces, thirty-six buccal, three lingual and one labial. In other words, there were five times more occlusal cavities than distal or mesial, seven times more occlusal cavities than buccal, eighty-six times more occlusal cavities than lingual and 259 times more occlusal cavities than labial. These figures should make us stop and think. We should realize and understand what they signify. It is well known that occlusal surfaces are more prone to have deep grooves with faults or fissures at their bases. No diet and no form of nutrition can or does change these faults or fissures. I have been advocating and shall continue to advocate the immediate attention and treatment of fissures regardless of the fact that no decay is visible. Nutrition is only valuable in maintaining the vital resistance. It cannot and does not prevent decay appearing in fissures, as it is impossible to keep them clean and free of food débris.

RULES AND REGULATIONS FOR THE CONDUCT OF THE DENTAL DEPARTMENT PEORIA PUBLIC SCHOOLS*

By C. CARROLL SMITH, D.D.S., Peoria, Illinois

RESPONSIBILITIES

Dentist: The school dentist is primarily responsible for the supervision of all the activities of the dental health department, including all dentists and assistants employed by the board of education, and for the enforcement of the following rules and regulations in all the public schools of the City of Peoria.

Principals and Teachers: The principal of each school, and every classroom teacher, is responsible for the enforcement of these rules and regulations.

All principals and teachers shall cooperate with the school dentist, and report all acute dental cases that come to their attention. They shall cooperate in the matter of dispensary appointments, being responsible for having the pupil at the dispensary at the time appointed, and shall report to the dentist, or his assistant, when the pupil is unable to keep the appointment.

*While these rules and regulations were worked out for a specific community, the policies are applicable to any community.

DENTAL DISPENSARY ACTIVITIES

Grades: Service in the dental dispensaries shall be confined to the pupils of the subprimary and first four grades, with careful followup work in the fifth grade of all operative service begun in the first four grades.

Relief and Preventive Service: Operative service shall be confined to prophylaxis, treatments for the relief of pain and unhealthful conditions, the simpler deciduous extractions, preventive measures and fillings, prevention rather than repair being the aim of the department.

No Major Treatments: No pulp devitalization, treatment or filling of root canals in permanent teeth shall be performed in this department.

No Major Repair Service: No gold work, crowns or porcelain fillings shall be inserted, and extensive amalgam fillings and restorations shall be employed but rarely, at the discretion of the school dentist, who shall reduce such work to the minimum.

No Major Extractions: No perma-

nent teeth shall be extracted in the dispensaries, and all extractions of teeth requiring local or general anesthesia shall be referred to the parents or guardian of the child, with instruction that this service cannot be rendered in the school dispensaries. The school dentist shall not be expected to extract such teeth, with or without an anesthetic. The reasons for so doing are apparent, as such extractions carried on in the schools would demoralize the clinic and materially frustrate its very aims and objects namely, preventive and health dentistry.

Emergencies: In case of sudden need arising from emergency of obscure mouth conditions, the school dentist shall be empowered to call competent counsel or help, or secure roentgen-ray service, it being understood that the dentist is to resort to such calls only in extreme necessity, and to keep them at the minimum, employing all the skill at his command until such special service is secured.

Infectious Conditions: The school dentist shall not be obliged to serve those who are persistently uncooperative, filthy or of persistent bad odor, whether they are white or colored. He shall not be obliged to serve those who have sores about the mouth and lips, sore throats, skin eruptions, sore eyes, pediculosis or any other infections.

Douglas School Dispensary, Peoria, Ill.

No Medical Service: The school dentist shall not at any time be expected or permitted to dress wounds, or render any medical service, including diagnosis of disease, except such matters as come within his province as a dentist.

ELIGIBILITY OF PATIENT

Inability to Pay: All cases of acute dental pain among pupils shall be cared

for, but only those children whose parents are unable to pay for the services of a dentist shall have their work done in the school dispensaries. Those who are property owners or business proprietors or who have a steady remunerative income are not eligible for dispensary service, except that the school dentist may take into account any mitigating circumstances of sickness, extreme responsibility or unusual complications, when the case is investigated by the principal, public health nursing association, associated charities or other reputable authority. However, the mere fact that a child might be served in the dispensaries because the parent, though able, will not secure dental service is no point of eligibility, since this item is liable to make many complications in the regulation of service of the department.

Written Consent of Parent: No work other than emergency shall be performed without a written request from the parent or guardian.

No Compulsory Service: The school dentist shall not force his services on or use undue coercion in the case of any patient.

Objectors to Service: Should a pupil or his parents or guardian object to continued treatment in acute or chronic cases. It shall be the province of the school dentist to notify such parents and explain the true status of the child's case, and to recommend that they consult a dentist of their own choice.

School Employes: No school employe shall receive dental service or diagnosis from the school dentist.

No Private Practice: The school dentist shall not use the dispensaries, their equipment, or supplies at any time during or outside working hours to render professional service to his friends or acquaintances.

DENTAL INSPECTION

Grades: The school dentist shall annually conduct dental inspection in the lower grades of the various schools, and shall keep a detailed record of his findings.

Notice: He shall send notices home to the parents or guardians, advising them that they consult the family dentist, or, if they are unable to pay for dental service, send an application blank to be signed for free service in the school dispensaries.

Objectors: Should any pupil or his parents object to such examination, a descriptive folder urging common sense care of the teeth may be sent home by the pupil.

Application Cards: A list of pupils examined who are given notices with application cards for free dental service in the school dispensaries shall be left with each teacher and principal, and it shall be the duty of teachers and principals reasonably to urge the filling out and return of said application cards, and to see that they reach the school dentist.

EDUCATIONAL PROGRAM

Grades: It shall be the duty of the school dentist to carry on an educational program of dental health in the various grades, using such methods of instruction as he may see fit in the way of lectures, stories, projects or drills, and it shall be the duty of the principals and teachers to cooperate in any reasonable way with the school dentist in such program.

Community: The school dentist shall respond to requests for lectures from mothers' clubs, home and school associations and local civic organizations.

RECORDS AND REPORTS

It shall be the duty of the school dentist to keep detailed daily records of all operations and dispensary activities, of all special dental inspections and their findings, and of all educational activities, and to render monthly and annual reports of the same to the board of education through the superintendent of schools. He shall render an account of any statistics the superintendent may ask for.

EQUIPMENT AND SUPPLIES

Dispensaries: The school dentist shall be responsible for the care of the equipment in the dental dispensaries, and shall see that it is left in a clean and orderly condition at the close of each day. At the close of each school year, he shall see that it is left in a sterile, orderly and safe condition.

Supply Cupboard: He shall have charge of the supplies in the dental cupboard at the administration building, and shall keep the same in an orderly condition.

Inventories: He shall render to the secretary inventories of the contents of the dispensaries, and of the cupboard at the administration building, at the close of each school year.

Requisition: He shall present to the secretary, by May 1 of each year, a requisition for supplies needed for the accommodation of the department for the succeeding year.

DENTIST'S ASSISTANT

General Duties: The school dentist's assistant shall be responsible for the carrying out of the clerical work connected with the department under the supervision of the dentist. She shall assist the dentist in the dispensary, in the dental inspections, in caring for the equipment, in compiling the requisitions and inventory, and in any way the dentist may see fit to avail himself of her assistance.

Time: She shall be at her post of duty each dispensary working day in time to have everything in readiness for the dentist to begin operating at 9 o'clock in the morning, and shall remain long enough after the dentist is through working in the afternoon to leave the equipment in a clean and orderly condition.

Clerical Duties: She will be expected, if necessary, to spend a reasonable amount of time outside of school hours to keep the clerical work up to date.

ELIGIBILITY OF DENTIST TO BECOME AND REMAIN SCHOOL DENTIST

College and Societies: The person shall be a graduate of a reputable dental college, a member in good standing of the Peoria County Dental Society, of the Illinois State Dental Society and of the American Dental Association.

Character: He shall be of good moral character.

Experience: He shall have had some practical experience in children's dentistry, or shall have taken instruction in such work in a reputable college, and have credentials from such college.

Educational Credits: It shall be his privilege and duty, when possible, to attend the annual meeting of the Illinois State Dental Society and the annual January meeting of the Chicago Dental Society; also to attend the annual meeting of the American Dental Association, at the discretion of the board of education. This should give him the same credit required of the teaching force in keeping abreast of the times.

Outside Calls for Lectures: He shall not have the privilege of responding to outside calls for lectures and exhibits that would interfere with his

time employed, except at the discretion of the board of education and superintendent of schools.

NO ADVERTISING

The school dentist shall not advertise in the schools any dentifrice or mouth lotions, or special make of tooth brush.

RELATION TO ORAL HYGIENE STAFF OF PEORIA COUNTY DENTAL SOCIETY

Advisory: In all matters requiring technical advice in the conduct of the dental department, it shall be the policy of the school dentist to consult with the oral hygiene staff of the Peoria County Dental Society, presenting their report to the proper school authorities for their approval or disapproval, and final action.

Investigation: Should the school dentist fail to keep in touch with the oral hygiene staff of the Peoria County Dental Society, it shall be the privilege and duty of said staff to make such investigation of his activities as shall protect the board of education and the public against inferior service, and thus maintain a high standard of efficiency for the department. After such investigation, should the oral hygiene staff find the school dentist negligent in his duties, or inferior in his services, they shall so report to the board of education through the superintendent of schools, and make such recommendations as shall tend to serve the best interests of all concerned.

LIABILITY INSURANCE

In order to protect the board of education against imposition from the public, it shall be the duty of the secretary to see that protective liability insurance is kept in force for the school dentist.

SOME ASPECTS OF THE DENTAL HEALTH PROBLEM*

By EVELYN C. SCHMIDT, Chicago, Illinois

SINCE no subject has been assigned to me today, I shall attempt to sketch briefly the dental health problems that we are facing in the United States, how we are attempting to meet them and what we are hoping for the future.

In the United States, as in Canada, there is a lack of adequate dental service. If we accept the statement that there should be one dentist for every thousand persons, only three states are adequately provided for, dentally speaking. Even if there were one dentist to every 1,400 persons, which some feel would mean adequate service, only five more states could be added. This means, therefore, that only eight of the forty-eight states have service that can be considered commensurate. Even these states present a problem within themselves; for though the number of dentists in proportion to the population may be all that is desired, the dentists congregate in the cities, leaving the rural communities without service. This fact must of necessity play an important part in any dental health program, whether nation or state wide. To compensate for and to supplement the ex-

*Luncheon talk given before the Ontario Dental Society, Toronto, Canada, May 29, 1925.

isting condition, twenty-seven states have passed laws licensing dental hygienists to practice. Unfortunately, the larger percentage of the dental hygienists are practicing in private offices, though every year shows an increase in the number who are entering the field of public health. Several states have introduced legislation that is worthy of attention. In New York State, the educational system allows state aid in an amount not to exceed $700 as one-half the salary of a dental hygienist to be employed in school work. Permission is granted to a limited number of school hygienists to take a six-weeks' summer course given to the school nurses at one of the state normal schools. In Pennsylvania, there is a similar law. Moreover, in 1926, that state will require one year of collegiate work prior to the professional study. Already there is a law that compels every dental hygienist to spend eight months in public health work before entering private practice.

I am citing these examples to show the general trend of the dental situation; namely, that states are recognizing the fact that there are not enough dentists to carry on both reparative work and a dental public health program; that the dental hygienist has a place in the program but that there must be legislative measures passed during this embryonic stage of her existence that will encourage communities to employ dental hygienists and will make the work in the field of public health remunerative enough to encourage girls to enter it. We have, therefore, as agents in our program, the dentist and the dental hygienist; also, the school nurse and the school teacher. Concentrated instruction in dental health should be introduced into all normal schools, training schools for nurses and public health nurses' training courses in order that these agents may be better informed in the fundamentals of dental health, in the proper evaluation of the various factors and in methods of presenting dental health facts.

Having listed the agents who can carry on a dental health program, we may ask what form it should take. During what period should the greatest energy and expense be expended? Statistics are available to show that from 30 to 65 per cent of children who are otherwise normal have defective teeth. We may assume that every child between 5 and 15 needs dental care. Wholesale corrections are impossible and impracticable; first, because there are not enough dentists, and, secondly, because corrections *per se* will never solve the problem. Moreover, many believe that the function of the state is to educate people, to point out to them their responsibility in health matters rather than to try to provide facilities for rectifying these conditions except in the case of the indigent. A logical procedure is, therefore, education looking toward prevention. For a time, this may result in what may seem to be neglect. A similar situation was faced when programs for the reduction of infant mortality were concentrated on keeping the well baby well rather than curing the sick child. Many people decried and bemoaned the neglect of sick infants, losing sight completely of the bigger problem, in which time is an important factor. Notwithstanding, most communities, according to Dr. S. Josephine Baker, consulting director of the United States Chil-

dren's Bureau and consultant in child hygiene for the United States Public Health Service, persisted in their "well-baby" programs, and the result was a phenomenal and almost immediate decrease in the incident of illness and death during infancy. With the dental problem, there cannot be the same spectacular and immediate results, but a program of prevention must in time show an improvement in the dental condition of school children, where conditions and results are most readily measured. What, therefore, is a dental health program that is sound from an administrative point of view and that approaches preventive dentistry? It should be a program of education carried on in prenatal clinics, in preschool clinics, in the public schools, in the offices of private practitioners, in industry and in hospitals, and should, in the case of the indigent, include provision for dental service. Obviously, the school is the most logical place for the practical application of this program because of the fact that large groups are organized and are under auspices that allow for uniform inspection, followup and teaching over the period of the years that are habit-forming and impression-taking. By this, I do not mean that we should not recognize the fact that, theoretically, instruction and effort must be concentrated on the prenatal and preschool periods, but that, practically, it works out so that we stress our efforts in the schools.

A school dental health program should be based upon education and prevention, and might allow for emergency work for all children and corrective work for indigent children. I do not wish to be misunderstood: I am not voicing the sentiment of any organized group, I am merely stating my opinion; not with the idea that it will carry weight, but with the hope that it may bring about a discussion that will lead to constructive and definite plans. As far as the educational phase is concerned, all children should have instruction in dental health yearly as part of the general health program. The instruction should be positive rather than negative in its presentation, should be adapted to the grade and should be correlated with other subjects in the curriculum. In many communities, high school pupils do not have health instruction, which to my mind is a grave error since they are the potential parents of a few years hence. Instruction in the grades should stress the importance of daily cleanliness; the choice of diet, which should include instruction about tooth-building foods, foods requiring mastication and detergent foods; and the advantages of early conservative preventive dentistry; also classroom checkups, examinations and followup.

It is the consensus of opinion in the United States that, when a dental service for school children is introduced in a community and funds are limited, the work should be confined to the children in the lower grades and that "preventive dentistry" should be practiced. This is so elastic a term that no two individuals or groups will agree on a definition and its application without qualifications. The Massachusetts Dental Hygiene Council outlined the following as comprising preventive dentistry, arranging the steps in the order of their importance. Their standard has been accepted by the Massachusetts Department of Public Health.

1. Adequate inspection and followup. This means the examination of the teeth and adjacent tissues of the mouth, preferably by the dentist, but it may be

done by the nurse, physician, dental hygienist, school teacher or the mother herself. School inspection should be made two or three times a year in order that there may be a checkup on the cases needing attention.

2. Care that will insure a surgically clean mouth. Since abscessed teeth are a menace to health, any that are in this condition or that cannot be saved should be extracted.

3. The routine use of silver nitrate, especially in the fissures of the first permanent molars.

4. The placing of simple fillings in deciduous teeth.

Many communities in other states work along this line in their school dental clinics; while many others include all types of reparative work, in some instances even orthodontia.

From a national point of view, we can never plan to standardize any policies or procedures for dental health education and dental service throughout the country owing to the fact that every state is a separate unit that frames most of its own laws pertaining to health. Some states, as I have said, believe that the function of the state is to point out the way—to educate only; that to provide free dental or medical service, or even service at cost, to any who may apply, is paternalistic and bad for the morale of the community. On the other hand, some states argue that since free education is provided, why not free health service?

Any national health group acts in a demonstrative and advisory capacity rather than in a mandatory one. This holds true with the United States Public Health Service, which is our federal public health organization, as well as with unofficial health groups. It also applies to the work of the American Dental Association. Our Association is composed of dentists who become members of their local dental society and by so doing automatically join the state and national organizations. We urge that a committee on mouth hygiene and public instruction be appointed in every state society and that this committee work with and through their state department of public health and state department of education, as well as unofficial health and civic groups, to further dental health propaganda in the state. So far, twenty-eight of our states have such committees. Their programs vary. In some instances, they have created sufficient sentiment so that a full-time dentist or dental hygienist has been appointed to work with the state department of public health or of education throughout the state. There are now ten states having these full-time workers. In other instances, at the suggestion of the committee, the governor has appointed a dentist to act in an advisory capacity on the health council in matters pertaining to dental health. One state society, through its council, has purchased films on dental health, which have circulated in the schools throughout the state. Two councils have conducted state-wide poster campaigns, awarding prizes to the schools submitting the best posters.

The Department of Dental Health Education fits into these programs by making suggestions and supplying material. The Department, which was established a year ago, purposes to study the various mediums of health education and the material that is available from various sources, and to develop material of its own. In short, it plans to act as a clearing house for dentists and others interested in the educational phase of the dental problem, to which they may write for information or ma-

terial or through which they can be put in touch with those who can fill their needs.

Canada is to be congratulated on having an efficient Dental Hygiene Council under Dr. Thomson; Ontario is fortunate in having Dr. Conboy as provincial director of dental service as is Toronto in having its work headed by Dr. Grant. With such a group, it seems incongruous for me to suggest that you write to us if you think we can help you, as I say to the dentists in our country. However, an exchange of ideas and a discussion of aims, methods, policies and results should serve as a shortcut toward our ultimate goal—the conservation of teeth and the preservation of healthy mouths—links in the public health chain.

TEACHING ORAL HYGIENE IN THE CHICAGO PUBLIC SCHOOLS

By M. OLIVE READ, D.D.S., Chicago, Illinois

The accompanying chart gives a condensed, though comprehensive, outline of the work as conducted in the Chicago Public Schools by oral hygienists under the supervision of Dr. Armin P. Baur.

In studying the chart, one may be impressed with the thought that there is a formidable array of problems to be overcome, with little encouragement and cooperation to offset these difficulties. It is true that these problems keep us constantly on our mettle, but at the same time, the enthusiastic support and cooperation of many parents, teachers and dentists make us feel that a work of enduring service is being done in the community.

The percentages of results obtained, as shown on the chart, represent work in the schools of foreign and mixed type only. The work in schools of the better, or American type, has been started this spring. As only one examination has been made in these schools, we can show no results of our work. We feel, however, that we have the hearty cooperation of the parents, and we hope that dentists will come to regard the problem from the standpoint of the relation of defective teeth to the health of the school child, and so will give us their more hearty cooperation in caring for deciduous teeth. We hope to have the habits of mouth cleanliness, correct diet and periodic visits to the dentist so well established in these children by the time they reach the fifth grade in school that they will require little if any supervision thereafter along this line.

TEACHING MOUTH HYGIENE

PROBLEMS

I. Large schools
II. Few workers
III. Large foreign population
IV. Indifference of parents
    1. Ignorance of importance of first permanent molars

2. Think reparative work, especially of deciduous teeth, unnecessary
3. "When they hurt, will have them out"

V. Opposition of parents (due to beliefs—political, religious, etc.)

VI. Indifference and lack of cooperation of teachers, (object to disturbance of room)

VII. Lack of cooperation of dentists, (refuse to care for deciduous teeth)

VIII. Shortage of free clinics, (private dentists helping out by caring for one free case a month)

ORAL HYGIENE RECORD (Ed. 4584)

NAME	ADDRESS		AGE
SCHOOL	ROOM	GRADE	TEACHER

YEAR		19__	19__	19__	19__	19__
DATE						
No. of Defective Teeth	Perm.					
	Decid.					
No. of Cavities						
No. of Fillings Placed	Perm.					
	Decid.					
No. of Extractions	Perm.					
	Decid.					
Malocclusion	Class 1					
	Class 2					
	Class 3					
Cleanliness—(Clean-Fair-Dirty)						
Use of Brush (Daily-Occasional-Never)						
No. of Absences Caused by Def. Teeth						

REMARKS ON DIET

REMARKS ON GENERAL HEALTH

REMARKS ON CONTAGION

(OVER)

Oral hygiene record used in Chicago Public Schools.

HOW WE MEET THESE PROBLEMS

In foreign and mixed schools*

1. Classroom talks—fairy stories in lower grades
   - *a.* Kinds of teeth
     Cutting, tearing, grinding
     Importance of first permanent molar
   - *b.* Need for care (Cleanliness; Prevention of disease; An aid to good scholarship)
   - *c.* Value of diet (Milk, dark coarse breads; Foods containing lime salts; Green vegetables, fruits, etc.)
   - *d.* Value of thorough mastication (Aid to digestion; Strengthens the teeth; Aids in cleaning teeth; Develops muscles and bones of face)
   - *e.* Value of periodic visits to dentist for mouth examination

* The entire school, grades 1 to 8 inclusive, was examined. There was little cooperation; and the lack of care of the deciduous teeth was marked.

2. Toothbrush drill
   a. In classroom
   b. Small groups in other room
3. Mouth examination, for defects and abscesses
   a. Group talks
   b. Individual talks
   c. Chart of mouth given to child
   d. Grade, put on report card, given on care of teeth and effort to have reparative work done
   e. Refer to private dentist, colleges for a small fee, free clinics
   f. Recall of children to check reparative work done
   g. Records kept of conditions found, and nature and amount of reparative work done
4. Use of posters, many made by pupils illustrating their understanding of the work, charts, slogans, pictures, honor rolls, playlets, etc.

II. Better type school (American)†

1. Classroom talks in story form (fairy stories and "chew-chew" engine), stressing cleanliness, value of diet, mineral fairies, etc.
2. Toothbrush drill
3. Mouth examination more detailed, as shown on oral hygiene chart; form letter, with chart of conditions found, sent to parents
4. Oral hygiene chart—complete record of each pupil for a period of five years
5. Examination this year of fifth grade, having no instruction in oral hygiene, to compare with condition of fifth grade pupils in five years from now after we have given five years of care and instruction to these pupils.

RESULTS OF WORK

SCHOOLS	Percentage of pupils with perfect teeth on first examination	Percentage with perfect teeth at last examination	Percentage perfect after those now going are completed cases
Audubon	11.2	46.9	79.0
Bancroft	9.0	35.9	72.7
Drummond	9.0	50.0	60.0
Hawthorne	14.0	59.0	84.5
Lincoln	16.3	66.2	70.4
Manierre	12.0	50.5	55.7
Moos	16.7	37.3	62.5
Morris	17.7	57.0	80.0
McPherson	21.8	40.96	53.75
Newberry	11.3	30.0	62.5
Ogden	15.0	42.7	62.5
Prescott	10.0	49.0	69.0
Pulaski	7.0	37.8	65.4
Schley	23.0	38.0	65.4
Schneider	12.8	50.0	70.0
Waters	24.0	53.0	80.5
Wicker Park	10.8	27.2	

† The kindergarten and first and second grades were examined. The parents and dentists cooperated better than in the foreign and mixed schools, and there were meetings of groups of dentists for discussion of school problems.

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Editorial

DELINQUENT MEMBERS

In every large organization in which membership is maintained through the payment of annual dues, there is usually quite a leakage from delinquent members. This is not so much a matter of financial inability on the part of the delinquents as one of forgetfulness, indifference or carelessness. Sometimes it is due purely to procrastination.

Whatever the cause, it behooves the officers of every organization to check up on this matter very carefully, and try to prevent such unwarranted loss of members. As the matter stands now in some organizations, it is sheer wastefulness to permit so many members to drop out from this cause.

In the American Dental Association, the problem is strictly up to the officers of the component societies—in their hands is placed the function of collecting the dues. Manifestly, even if it were so provided in the Constitution, it would be impossible for the officers of the parent body to reach the individual members in the intimate way that the component officers can, and yet it must be recognized that every member lost to the component society is likewise lost to the parent organization.

A little timely effort on the part of our branch officers will minimize this serious loss, and will hold our organization closer together in all its integral entities. This is a very important matter, affecting as it does our aggregate membership and working for good or ill as regards our reputation as a representative organization. While numbers do not mean everything, there is after all in a large membership a psychology that carries weight,

not only with the profession itself but also in the estimation of the public. With a goodly portion of all the ethical dentists in every locality belonging to one outstanding organization such as ours, there is no question as to the impelling force exerted in giving a creditable status to dentistry.

The membership should grow steadily year after year as the new graduates are added to our ranks; but this accession of fresh recruits will be largely counterbalanced if the delinquent list is permitted to increase so as to materially deplete our ranks. Before the Louisville meeting, our component officers should check up carefully on their tardy members, and come in with a slate as nearly clean as possible, to the end that the record may show a larger and more representative membership than has ever before existed in the history of the organization.

C. N. JOHNSON.

THE HABIT OF ATTENDING MEETINGS

Presence at meetings produces, I am sure, in different members of the audience, as it has in me, various emotions. These emotions must apparently fall into one or more of the following subdivisions: admiration for the subject or the speaker; feeling of one's own inferiority in having done so little; the desire to imitate that piece of work and that method; the determination not to overlook this or that in the future, and regrets at having failed to observe this and that.

Wishes, regrets, determinations like these are bound to have only the most beneficial effects on our future activities, because they are stimulating to better performance of duty.

When we stay at home and work in our own circle only, good work might be done and creditable, but our accomplishments, our thoughts, our ideals, are slow to reach the outside world. The good we may have done has had only little influence, and, for the same reason, recognition by our fellow workers is sure to come only very slowly. At meetings, when we allow others to peep into our minds, a quicker estimate and appreciation of our value is gained, the influence for good spreads quicker and wider. Our leaders, the men who have honored and exalted our profession, all of them were regular in their attendance at meetings, spreading the knowledge they possessed and learning from the humblest and youngest in the meeting.

Attendance at meetings has often led to ties of the most fruitful and warmest friendships among medical men the world over. History of medicine, and of our branch especially, contains many records of the wonderful effects of exchange of thoughts among friendly spirits, just as these medical meetings.

Attendance at meetings must not be limited to those of our immediate circles. The larger the group of individuals banded together, the greater is the probability of valuable and stimulating contributions at that meeting.—Marcus Feingold, in *J.A.M.A.*

Medical and Dental News

COLORADO

Colorado Dentist in India: Dr. Harry Hardy, of Las Animas, a graduate of the University of Denver, 1920, is in the British service, and located at Bombay.

GEORGIA

Advisory Executives of 7th International Congress: The following have been chosen as officers of the Georgia State Advisory Committee of the Seventh International Dental Congress: president, M. D. Huff, Atlanta; first vice president, A. A. Williams, Columbus; second vice president, N. A. Teague, Augusta; secretary, G. A. Mitchell, Atlanta; treasurer, N. G. Slaughter, Athens.

ILLINOIS

Dr. Brophy Honored: Dr. Truman W. Brophy of Chicago was awarded the Miller prize for dental research at the opening of the annual meeting of the Inter-Dental Federation at Geneva, August 3. Dr. Brophy was also made an honorary member of the Swiss Odontological Society.

Chicago Dental Society Officers: The newly elected officers of the Chicago Dental Society are as follows: president, M. M. Printz; vice president, Frank G. Conklin; secretary, Hugh G. Fisher; treasurer, John H. Cadmus; librarian, Ashley M. Hewell.

MARYLAND

Sickness in School Children: Morbidity records of about 5,000 public school children at Hagerstown, Md., for the school year 1923-1924, showed the frequency of common colds to be twice as great as that of any other illness. Headache, digestive disorders, sore throat, toothache and influenza were next in frequency in the order named.

MASSACHUSETTS

A New Public Health Service: The Massachusetts General Hospital has taken a step that is perhaps unique for a general hospital by instituting a real campaign for the education of the public along health lines. This health source consists of the periodical publication in the daily press of complete and authoritative articles by members of the staff dealing with matters of general and common interest. These articles appear, and will continue for a time to appear, weekly in prominent Boston newspapers. Several have already been published, dealing with body mechanics, hay fever and asthma, varicose veins, basal metabolism and rickets.—*Boston M. & S. J.*

MICHIGAN

Pontiac Plans Additional Clinics: At least two clinics will be added to those already operating in the public schools, three in number, and the clinic operated by the department of public health. Parent-teacher associations and the board of education are lending aid in developing the clinics. All grade school children were included in the tooth survey conducted last fall, including those in the kindergartens. Preschool children were cared for one half day each week. Instruction was given parents, teachers, pupils, including high school, through lectures, slides and informal talks. Development of the 100 per cent idea resulted in twenty-four rooms receiving banners.

NEW YORK

New York University Establishes New College of Dentistry: With the acquisition of a college of dentistry, New York University has added the second school of a value approximating one-half million dollars to its eleven other schools and colleges

within the last month, the other being the school of aeronautics. The college of dentistry was officially established by the Council of New York University at its last meeting, according to an announcement from Chancellor Elmer Ellsworth Brown. The new school will be known as the College of Dentistry of New York University. The property consists of two six-story buildings at 201-213 East Twenty-Third Street.

Southern California

Advisory Executives of 7th International Congress: The following have been chosen as officers of the Southern California Advisory Committee of the Seventh International Dental Congress: president, Bert Boyd, Los Angeles; first vice president, G. Maurice Crow, Pasadena; second vice president, E. J. Wylie, Los Angeles; secretary-treasurer, Charles E. Rice, Los Angeles.

Officers of Southern California Dental Society: The following have been elected as officers of the Southern California Dental Society: president, A. H. Gilbert, San Diego; president-elect, J. Walter Gray, Los Angeles; vice president, George H. Walker, Los Angeles.

South Dakota

Advisory Executives of 7th International Congress: The following have been chosen as officers of the South Dakota State Advisory Committee of the Seventh International Dental Congress: president, B. H. Kerr, Huron; first vice president, J. L. Martin, Vermilion; second vice president, A. O. Stutenroth, Watertown; secretary O. W. Hanson, Madison; treasurer, M. R. Hopkins, Aberdeen.

Texas

New Dental College Building: Plans are being drawn for the new Texas Dental College building, Fannin Street and Blodgett Avenue, Houston.

Fort Worth Dental Society Officers: The newly elected officers of the Fort Worth Dental Society are as follows: president, J. T. Edwards; vice-president, W. H. Nugent; secretary-treasurer, B. B. Weldon.

Joint Medical and Dental Society Meeting: The El Paso County Medical Society and the Southwestern Dental Association recently met in joint session. An address on "Mouth Infections in Relation to General Health" was given by Dr. Arthur D. Black, Chicago.

Vermont

Advisory Executives of 7th International Congress: The following have been chosen as officers of the Vermont State Advisory Committee of the Seventh International Dental Congress: president, C. H. Cole, Vergennes; first vice president, W. R. Pond, Rutland; second vice president, H. B. Small, Burlington; secretary, C. R. Woods, Rutland; treasurer, Fred S. Braley, Bennington.

Wisconsin

Advisory Executives of 7th International Congress: The following have been chosen as officers of the Wisconsin State Advisory Committee of the Seventh International Dental Congress: president, M. H. Mortonson, Milwaukee; first vice president, W. I. McFarlane, Tomahawk; second vice president, George A. Stratton, Ashland; secretary, R. W. Huegel, Madison; treasurer, P. A. Powell, Beloit.

Foreign

Dental Hospital of Sidney: This is the only institution of its kind in New South Wales. It serves the dual purpose of affording a place of instruction for the students of the University and for rendering dental service to the necessitous poor. It is controlled by a board of management composed of dentists, representatives of the university, and nominees of the government of the state. The honorary medical staff comprises a pathologist, five consulting physicians, two consulting honorary surgeons, three radiographers, and some anesthetists. The honorary dental surgeons and clinical instructors (including dental radiographers) comprise twenty-eight dental surgeons. On these two staffs are some of the most eminent men in their respective professions. The superintendent is always a man of high standing and undoubted ability. The hospital is open for the treatment of patients from 10 a. m. to 4 p. m. daily, Saturday excepted, and, as can be readily imagined, a vast amount of work is done during the course of a year. The honorary dental surgeons are appointed by the board of control. The university professor and lecturers in surgical and mechanical dentistry are *ex officio* honorary dental surgeons of the hospital.—*Oral Topics,* June, 1925.

Decline in Medicinal Use of Alcohol: In Edinburgh, forty years ago, every patient cost on an average $10.75 a year for

drink, as part of treatment; last year, every patient cost about 10 cents. This illustration of the reduction in the use of alcohol in the treatment of disease was given at a National Commercial Temperance League luncheon in London. In 1900, every patient admitted into the great London hospitals received on an average nineteen tablespoonfuls of brandy as part of the treatment. Last year, every patient received on an average about three tablespoonfuls. All over the world there had been a great decline in the use of alcohol in treatment of disease.—London Letter, *J.A.M.A.*, June 6, 1925.

General

Harrisburg Health Federation: The Dauphin County Medical Society plans to establish an organization to be called the Harrisburg Health Federation which, it is said, will have as component organizations a tuberculosis society, a heart society, a cancer society, a mental health society, a child welfare and other societies. The object is to comply with recommendations of the American Medical Association, endorsed by the state society, to establish various clinics and to prevent a multiplicity of societies and duplication of work. The society seeks to coordinate all the hospitals and clinics of the community as centers for medical education and to extend their educational facilities to physicians interested.—*J.A.M.A.*, June 27, 1925.

Dentistry a Specialty of Medicine: At the recent meeting of the Dental Educational Council of America, the secretary was instructed to inform the dental and medical professions through the various journals that the Council unanimously adopted the following: "The Council cordially endorses the Carnegie Foundation's formal conclusion that dentistry is an independent division of health service which is attaining the full equivalence of an oral specialty of medicine, and commends these views of the Foundation to the attention of the public and of the medical and dental professions."—*J.A.M.A.*

Navy

Naval Dental Corps: The following changes in duties and stations of officers of the Navy dental corps will be made: Lieutenant Commander George H. Reed from naval hospital, Canacao, P. I., to receiving ship, San Francisco; Lieutenant Charles O. Sandstrom from marine detachment Managua, Nicaragua, to the naval training station, Hampton Roads, Va.; Lieutenant Harry L. Kalen from Naval Academy to submarine base, Coco Solo, Canal Zone; Lieutenant Erroll W. Willett from naval station, Guam, to receiving ship, San Francisco; Lieutenant Virgil H. Traxler, at naval hospital, Brooklyn, to additional temporary duty at submarine base, New London, Conn.; Lieutenant Alfred R. Harris from naval hospital, Mare Island, Calif., via U. S. S. Chaumont about September 1, to naval station, Guam.—*Army and Navy Register*, July 4, 1925.

Army

Dental Corps: Lieut. Col. Frank P. Stone from duty at medical field service school, Carlisle Barracks, Pa., to duty at Fort Riley, Kan.

Maj. Frederick R. Wunderlich from duties at University of Minnesota, Minneapolis, about June 12 to Carlisle Barracks, Pa., medical field service school for duty with 1st medical regiment.

Capt. Rufus W. Leigh from duties at Army Medical School, Washington, July 1 to duty at Fort McDowell, Calif., via New York City and transport to leave about Sept. 22.—*Army and Navy Register*, June 13, 1925.

Dental Corps: Maj. Rex McK. McDowell from duty at Fort H. G. Wright, N. Y., to duty in Philippines via San Francisco and transport leaving about Sept. 3.

Maj. Charles M. Taylor from duty in Philippines to duty at Vancouver Barracks, Wash.—*Army and Navy Register*, July 4, 1925.

Deaths

Cohen, Alexander H., Little Rock, Ark.; Tulane University of Louisiana School of Dentistry, 1905; recently, aged 44.

Van Ornam, James C., Murphysboro, Ill., recently.

Walker, William Wallace, New York City; Baltimore College of Dental Surgery, 1884, recently.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Antirachitic Activation of Foods and Cholesterol: Following the discovery that ultraviolet rays can endow inactive oils Alfred F. Hess, (*J.A.M.A.*, June 20, 1925) carried out experiments which demonstrated that various foods can be rendered protective against rickets by exposure to radiations from the quartz mercury vapor lamp. His conclusions based upon these experiments are that cholesterol, which is present in almost all animal cells, and phytosterol, present in almost all vegetable cells, were the substances that were activated by the rays, the change taking place being chemical in nature. Experiments in feeding skin and irradiated skin to rats indicate that the antirachitic effect of the violet ray on man and animals is due to activation of the cholesterol in the superficial layer of the skin. Under prolonged irradiation cholesterol becomes inert, which suggests that too long irradiation tends to nullify the beneficent effect of the rays. Experiments in feeding green vegetables grown under tropic suns and in feeding green vegetables subjected to irradiation in the laboratory indicate that the former cannot be depended on to protect against or cure rickets. Of the foods subjected to irradiation, dried milk seemed most potent as an antirachitic, and it retained this property in marked degree after three months. While an infinite variety of foods can be irradiated successfully, the procedure has little practical value as far as infant feeding is concerned because of technical difficulties, and in consideration of the fact that cod liver oil and egg yolk are readily available and assuredly protective against the condition. That foods, as well as cholesterol and phytosterol, can be endowed with antirachitic potency is of decided theoretical value and interest as demonstrating a definite physiologic process by which ultraviolet rays can bring about a change in the tissues and furnishing a chemical basis for interpreting one of the effects of heliotherapy.

Signs of Incipient Periodontal Disease: Twenty diagnostic signs, collected in his own clinical experience and verified by other periodontists, are listed and described by Harold Keith Box (*Oral Health*, June, 1925), with the thought of assisting in the early recognition of the disease, and so with the elimination of the lesions. The signs, in brief, are: 1. Traumatic crescent. 2. Congestion of marginal gingiva. 3. Mobility No. 1 (so slight as to escape casual observation). 4. Recession of the marginal gingival line. 5. Asymmetric recession of the marginal gingival line. 6. Recession of the alveolar crest line. 7. Increased radiolucency of the alveolar crest or lamina dura. 8. Disturbance of normal contour of the alveolar crest. 9. Increased widening of the pericemental space. 10. Mobility No. 2 (increased beyond that designated as No. 1.) 11. Shortening of the crest of the septal gingiva. 12. Linear depressions in the alveolar mucosa. 13. Stillman's clefts. 14. Absence of stippling. 15. Festoons. 16. Injection of blood vessels in the marginal gingiva. 17. Increased depth of the gingival crevice. 18. Epithelial nodules. 19. Distended veins in the mucosa. 20. Pus cells in the crevicular exudate. The sequence given is not invariable.

The Tired Child: Max Seham (*Pub. Health Nurse*, June, 1925) differentiates between acute fatigue, the natural result of work or play, and which conserves the health and promotes physical development, and cumulative or chronic fatigue, a pathologic condition, characterized by abnormal signs and symptoms. He says: "The chronically tired child shows poor vitality and lack of energy. Good vitality means a reserve fund beyond what is immediately needed. The smaller this reserve the less prepared is the child to meet exigencies with ease and to stand the usual wear and tear without serious injury. A healthy child laughs, runs and romps and acts spontane-

ously; the tired child has to be urged and coaxed to do what healthy children do naturally; he is conscious of an effort, he must exert himself and the more he does so the more tired he becomes. The tired child dreads to perform the functions that are ordinarily required of him, because tiredness so *reduces the efficiency* that he can do so only with difficulty. He cannot accommodate himself to each ordinary task, and he is not equal to exertion without painful sensations." He emphasizes the fact that while work may be classified as muscular, mental and glandular, the activities of the different systems cannot be separated by lines of demarkation, the fatigue, whatever its source, being general and involving both body and mind. The child who is free from physical ailments and yet does poor work in school or is irritable will often be found to be suffering from chronic fatigue. Dr. Seham illustrates the procedure of diagnosis by three cases, and concludes that irrational living is the most potent factor in chronic fatigue. An excellent chart outlines a daily schedule of rational habits for school children (6 to 15 years).

Child Health Conservation in the Tropics: In no place in the world does a child have such close supervision, I believe, as in the Canal Zone. This supervision takes place from the time of birth until graduation from high school. Public health nursing in the Canal Zone began with the introduction of the physical examination of the school children. Although this examination was not a new feature, the work had theretofore been on a different basis from that as now conducted. At the beginning of the school term the children are given a preliminary examination by the nurse, the procedure being as follows: they are weighed and measured without shoes, chest expansion is taken, and they are questioned about the use of the toothbrush and other hygienic habits and as to the date of their last vaccination. They are next turned over to eye, ear, nose and throat specialists. In this examination a very careful test is made, using the head mirror, ophthalmoscope, and ear and nose speculum. Next they are examined by a specialist who tests their heart and lungs, and examines them for other defects. After the examination, notices are sent to the parents informing them of the existing defects, with the request that these be corrected as soon as possible. If, after a reasonable time, they have not consulted a physician, the public health nurse visits the homes and explains the necessity. According to statistics of the preceding year about 75 per cent of the pupils with remediable defects had them corrected. The cost to Canal employees for the correction of defects is very nominal, and is based on a sliding scale in accordance with the income of the employee.—Katherine F. Luby, in *Pub. Health Nurse,* June, 1925.

Ethylene Anesthesia: Observations based on 131 major and 208 minor operations are reported by R. Stuart Adams (*Res. Anes. & Anal.*, June, 1925), as his contribution toward determining the true status of ethylene. Most of those coming in contact with the anesthetic complained of the odor. The matter of relaxation, he regards as relative. Ether produced greater relaxation, but in comparing ethylene with nitrous oxid, the question as to whether secondary saturation was employed with the latter had to be considered. He finds greater ease of administration a great advantage of ethylene. Nausea and vomiting are dependent on many factors besides the anesthetic employed, but seemed to be more prolonged after ethylene than after pure nitrous oxid-oxygen anesthesia. Very precipitate retching is obviated by the avoidance of rebreathing. Two patients having severe kidney complications died, but it was felt that the anesthetic played a very unimportant rôle in the fatal outcome. In cardiac and respiratory complications, ethylene proved highly satisfactory. Cyanosis was decreased and no definite cases of acidosis were noted. Lack of sweating helped to lower the incidence of postoperative pneumonia. Preliminary medication was always used to advantage, but ethylene was found to be more of a respiratory depressant under these circumstances than nitrous oxid. Only one patient complained of headache after ethylene anesthesia. In thirty cases, varying amounts of ether were given, these patients being highly resistant or presenting cases that demanded very deep anesthesia.

Infection of Tonsilloglottic Region and Cervical Cellulitis: Ten cases of infection of the tonsilloglottic region associated with cervical cellulitis are reported by Virginius Dabney (*J.A.M.A.*, July 11, 1925). Four cases proved fatal. He believes that

often there are early symptoms whose recognition might have served to prevent death by suggesting preventive treatment, such as those beginning with a deep seated peritonsillar abscess or an improperly extracted carious tooth or having its source in a latent chronic follicular tonsil infection. He comments: "Cellulitis of the neck is Nature's warning that the barriers against respiratory infection have broken down and constitute a cry for assistance which every thoughtful, observant attendant will heed with immediate respect and thorough treatment. It must not be forgotten that dental caries has often caused authentic cases of Ludwig's angina, and extraction of such teeth has resulted in resolution of the septic process. Ludwig reports such cases himself, without any other treatment. In only one of these cases did the medical attendant notice or attach any importance to the cellulitis, and my prognosis of death stamped me in two of the fatal cases as an alarmist." In Dr. Dabney's cases, the streptococcus, always present, whether causative or not, according to the literature reviewed, was found to be the causative factor.

Two Sides of the Face: A correspondent to the *Dental Surgeon* sends the following quotation: "With many persons the left side of the face is better looking than the right. This discovery was first made by the Chinese. The truth of the curious statement can easily be verified by the examination of a dozen faces. It is said that actors, actresses and public singers always make a half turn to the right when they wish to impress their audiences." The correspondent suggests that the habit of sleeping on the right side tends to compress the right more than the left and that this practice may explain why the left is the more beautiful. The *Dental Surgeon* doubts the correctness of the original hypothesis, stating that previous experience has never suggested that the left side of the face is the more beautiful, nor has careful study since the suggestion was made altered the opinion on the subject. An attempt to support a general statement as regards the anatomy of the face by evidence based upon observation of only a dozen examples is called absurd. Their readers are asked to report on any observations they may have made on the subject.

Duty of Professional Men to Public: If honesty is obligatory in the business world, what shall we say of the professions? Repeatedly the edict has gone out that the professional man owes to the world a higher order of ethics than the business man. The helplessness of patients when in the hands of a physician or dentist places upon these men an obligation greater than that which binds the business man. This is a fact which seems so difficult to implant in the mind of the average professional man, and yet it is really the basis of whatever prestige the professions have enjoyed. That this is not easy of comprehension by the dental student is not to be wondered at. Professional spirit is not ordinarily an indigenous plant—it must be cultivated in the student's mind from the time he enters college till he graduates. Even then there are some soils in which it seems almost impossible to make it grow, and these are the men who really have no place in a profession. But even with students of good impulses it cannot be expected that the true essence of professional life is carried with them into college. The motives which impel men to study dentistry are not so different, one student with another. There may be among some students a higher resolve than among others, but with all students the mainspring of the motive which induced them to take up dentistry was usually the belief that through this medium they might make a decent living and attain a respectable position in the world. The idea of service for its own sake seldom enters the consciousness of a student, no matter how good a student he may be. It is only after the mellowing influence of his contact with suffering humanity in professional relationships, and the association with older men of his own calling, whereby he gains a glimpse of the glory of service, that he begins to grasp the essentials of what we have come to feel is, after all, the chief motif of professional life. And until a young man acquires this vision he is not equipped to enter fully into the kingdom of the highest professional enjoyment and satisfaction—in other words, he is not in a position to get the most out of his professional life.—C. N. Johnson, in *Chicago Dent. Soc. Bull.*, June 26, 1925.

Anesthesia in Cardiac Disease: To minimize the risk in anesthesia in cardiac conditions, Edwin Schisler (*Res. Anes. & Anal.*, June, 1925) advocates careful examination

of the heart, the vasomotor and vascular system and the lungs and respiration, and a laboratory study of the blood and the urine. There is further taken into consideration the nature and probable duration of the proposed operation and the selection of a trained expert for the administration of the anesthetic, and absolute quiet is maintained in the operating room. His conclusions are: 1. The chronicity and type of a nephritis, not albuminuria or the presence of casts, are the determining factors in operative risk. 2. Severe valvular lesions with hypertrophy, even though accompanied by hypertension, carefully observed, do not always contraindicate general anesthesia without a subsequent increase. 4. A tumor mass may be an important factor in the production of hypertension. 5. A careful and complete study of cases will decrease the number of inoperable risks. 6. Thorough preoperative examination and observation will make for more accurate estimation of surgical risks.

Deficiency Diseases: Throughout all the arguments pro and contra the low protein diet there lies one basic principle that both sides of the controversy must agree upon—that the main protein requirement is not so much the quantity as the quality of the protein. A flesh abstainer may live for years in perfect health provided that his vegetable proteins be supplemented by those of milk or eggs. Truly, they are, as McCollum calls them, "protective foods." According to him milk, and milk alone, determines the physique of a race, regardless of climate, occupation or hygiene. He seems to prove his case. The Scandinavians and the Swiss, possessing one cow to every two inhabitants stand in the front rank of big and hardy peoples. The pastoral Arabs are famous for their magnificent physique. They live on sour milk and dried curds from camels and goats, with dates and some cereal. The Masai, a negro tribe of Kenya Province, East Africa, average above 6 feet in height and are powerfully built. They live almost altogether on cow's milk mixed with cow's blood. As a tribe they are famous for strength, endurance and fighting ability. Any people whose staple food is milk always are found to be unusually large, strong and aggressive. Where milk is lacking, as among the Sicilians, Syrians and East Indians, the people are generally small, of light weight and of delicate limbs. In grain-growing regions, where cattle raising is less profitable than agriculture, defective health and stunted bodies are common because the cereal diet is not supplemented sufficiently with the protective foods, milk, eggs and glandular meats. Not only is the body poorly developed, but often defects in man's temperament becomes inevitable. Without proteins of high quality amino-acids, man becomes nervous, irritable, low spirited and tires easily. McCollum believes that much of the nervous instability, so prevalent today, is due to this deficiency rather than to the high pressure of modern life.—Fresenius Van Nuys, in *Boston M. & S. J.*, June 25, 1925.

Tuberculosis of the Tongue: Finney, J. M. T., and Finney J. M. T., Jr., (*Surg., Gynec. & Obst.*, June, 1925) present a very well written article on this important subject. They report in detail fifteen cases and analyze in tabular form the results they find with all fifteen cases. Five appear to merit classification as primary lesions, which they realize is a very large percentage; on the other hand, in these cases no additional tuberculous lesion was discovered on careful examination. Three of these cases were operated on with the assumption that they were carcinoma. In two of the cases the lack of induration in the lesion was noted in the examination but its significance was not then realized. In four cases, the tongue lesion was noted in the examination, but its significance was not then realized. In four cases the tongue lesion was the means of bringing the patient to the doctor and thus led to the discovery of a most extensive tuberculosis previously unsuspected. There are only two cases in women in contrast to thirteen in men. Direct trauma seems to be the only important causative factor in any of these cases, but in no case was the trauma charged to that popular bugbear, the pipe-stem. Pain does not seem a prominent factor. The majority of the patients were in the forties; therefore, tuberculosis of the tongue may be classed as another affliction of middle life. There was no predilection for the development of the lesion on any special part of the tongue. The authors have no special treatment to advocate. If the case seems to be primary, however, wide excision is indicated.—Abstr., *Boston M. & S. J.*, June 25, 1925.

Teaching Mouth Hygiene to Children: From the standpoint of beginning at the beginning, which is generally conceded to be the rational way, or working in a concerted and systematic manner to teach the children of the state the importance of, and how to take care of their teeth in a manner effective and yet attractive to the child, Texas dentists, as represented by the state society, are just now beginning to gain momentum. It is true that the dentists of San Antonio, Houston, Fort Worth and possibly a few other towns of the state, have for some time been at work upon angles of this problem, but not before "Dental Health Week" in Texas was planned and put on by the Council of Mouth Hygiene and Public Instruction of the Texas Dental Society, had a general concert of action in the state been attempted. Also, it is gratifying to note from the council's report at the San Antonio meeting, as well as from reports made by a number of local societies, that this beginning was evidently quite successful in creating interest, not only among the children, but among the people generally. An interesting feature of the campaign was the contest for prizes by the children in essay writing, poster drawing, etc.; for when you get a lot of youngsters started in this sort of contest (as in all other scraps) backed by their parents, something is going to happen. While the best thing that happened to the children entering this contest was that they learned something of their teeth and care in a way they are not likely to forget, some of them won prizes and their poster drawings helped to call attention of busy adults to the purpose of dental health week.—*Texas Dent. J.*, July, 1925.

School Dentists in Austria: At the recent conference of the Austrian Dental Association, an important paper was read by one member on "School Dentistry." The arguments enumerated were directed to prove the usefulness of the dentist as a functionary of the elementary school, not only for the repair of bad teeth but for the prevention of dental disease. He spoke on the question of undernourished children and pointed out that it was but a poor policy to provide children with food unless they had teeth wherewith to chew it, and defective teeth were only too common among children of the elementary schools. He explained the aims of the School Dentists' Society to be the introduction of teaching in dental hygiene, the instruction of the teachers themselves in the same subject, and the provision for dental inspection and treatment in schools. In the discussion that followed several medical men and dentists took part, all of them speaking in favor of the proposal. Dr. Haggenmacher of Budapest made the emphatic statement that there was scarcely a disease that could not be brought about through a diseased condition of the mouth, and he emphasized the importance of the school dentist as a factor in preserving the national health.—Vienna Letter, *Boston M. & S. J.*, June 26, 1925.

Lister—England's Greatest Surgeon: Pasteur's experiments on fermentation and studies of the disease of anthrax, leading to the discovery of the existence of minute living organisms capable of invading human tissue, led Lister to believe that some such bacteria were the cause of wound infection. Concluding that the oxygen of the air was the chief source of these bacteria, Lister began a search for something that would prevent the entrance of such organisms into the wounds. To exclude the oxygen of the air was impossible, hence the problem became that of protecting the wound from the dangerous effects of the germs. Working deliberately and with the utmost concern for his patients, Lister's progress was slow, but his errors were few and remarkably free from disastrous results. Where Pasteur employed heat for the destruction of bacteria, Lister was obliged to rely upon chemical antiseptics. The first successful means employed was carbolic acid, which, applied undiluted to abscesses and wounds, irritated the tissues severely. The endeavor to find a diluting medium without destroying the antiseptic properties of the acid nor irritating the tissues, formed the subject for experiments for many succeeding years. Bacteriology was still in its infancy, and Lister had no well-defined knowledge of the germs he set himself to destroy. As an additional precaution, therefore, he devised a spray for purifying the air of the operating room, the instruments, and both surgeon and patient. He later abandoned the spray as of no efficiency in destroying the bacteria infecting the air. Lister's antiseptic treatment underwent many modifications. The interior of the body was discovered to be inherently free from germs, and when wounded, ca-

pable of healing rapidly and safely if infection from the patient's skin, the instruments, and other outside sources could be excluded. Consequently, preventing the entrance of bacteria into the wound seemed far more commendable than attempts to destroy the germs after they had found lodgment in the tissues. This was the step from antiseptic to aseptic surgery, of which Lister is the founder. Heretofore instruments were washed after an operation and carried about in the pockets of the surgeon in readiness for the next operation; the surgeon himself would postpone the washing of his hands until after the gory work was completed. As the knowledge of bacteria became more definite Lister realized the importance of scrupulous cleanliness in the operating room and complete sterilization of instruments, patient, and surgeon, and in fact of everything that comes into contact with the incision during the operation and subsequent dressings. The dangers resulting from such operations were so reduced by these measures that the *British Medical Journal* declared that Lister "had saved more lives by the introduction of his system than all the wars of the nineteenth century together had sacrificed." And thousands of people alive and well at the present time owe their lives and their relief from suffering to the means devised by Lister for preventing infection.—Mida Abbott, in *Pub. Health*, May, 1925.

Early Treatment: Early treatment in general is discussed very briefly by L. M. Waugh (*Internat. J. Orthodontia*, June, 1925), and three cases reported, one in which deformity due to lip biting in a boy, aged 3, was corrected after treatment extending over one year and nine months; one in a boy, aged 3 years and 3 months, treated for an impacted molar, which appeared after four months; and a third in a boy, aged 4½ years, whose deciduous maxillary incisors were locked to the lingual, the condition being corrected in five months of treatment.

Preventive Dentistry: The teeth, like other tissues of the body, depend for their proper development and growth on normal nerve and blood supply and healthy adjacent tissues. Causes that interfere with good nutrition and growth of the body, such as toxins generated by diseases, by deficient oxidation, by over-fatigue, by indigestion, etc., which produce general malnutrition, affect the teeth also. Their effects are registered by defects of the teeth in a similar way to physical defects elsewhere. The problem of sound teeth is a sound body. Histological examinations frequently will reveal defects in apparently sound teeth, and histologists claim to be able to tell, by such examination, the periods of life at which ill health was present. Against these early defects the dentist is often helpless, but their prevention must be attempted, and parents should be repeatedly instructed that ill-health and unhealthy conditions in children will assuredly affect their teeth; so may there be more hope for the preservation of their own teeth in the coming generations than there, apparently, is in this.—A. J. Reye, in *Dent. Sci. J. Australia*, June, 1925.

Replantation of Teeth: A case of replantation of the upper right central and lateral incisors in a 12-year-old boy, after forty-eight hours, is reported by Gerald Franklin (*Dominion Dent. J.*, June, 1925). The teeth, which had been knocked out in a fall, were cleansed, the periodontal membrane being removed, and were immersed in alcohol. The next morning, the root canals were opened, cleaned, enlarged with acid and filled with chloroform and guttapercha. The teeth were shortened by smoothing off the apices. Silver nickel bands were made for the two dislodged teeth and for the two teeth adjoining them and these were placed on the respective teeth. The technic for reimplantation is thus described: "The loose teeth were then washed off and placed in warm sterile Ruiger's solution. The sockets of the teeth were curetted lightly for removal of clots, and washed with warm sterile Ruiger's and the two teeth inserted into place. A plaster impression of the four bands in place was taken and poured in a mixture of half investment and half plaster. When set the impression was separated from the model. A gold wire was then soldered on the labial and lingual of the bands, thus uniting them into a fixed splint. This was polished and washed and cleaned with alcohol. The loose central and lateral were then cemented in their places in the splint. The area was then anesthetized by infiltration and the sockets washed out with Ruiger's. The splint with two teeth in place was washed with Ruiger's and fixed into place by means of cement on the two

remaining bands. After four weeks' time the splint was cut into pieces and removed." The teeth were found very firm. The patient was seen last in March (after six months) and reported that he had full use of the teeth, which were firmly set in place. The gingivae were in good condition.

Actinotherapy: In a recent issue of *The Journal,* reference was made to the recent rapidly developing elucidation of some of the effects of light on foods and nutrition. These influences, whether exerted directly on the body or through the irradiation of extraneous substances, are associated with rays having a shorter wave length than those of the visible portion of the spectrum. Rays longer than about 313 millimicrons seem to have no effect in rickets; hence, the therapeutic potency of sunlight in this disease at least is probably due to the ultraviolet rays. Hess has pointed out that the longer, visible waves may exert a counteracting force on the action of the ultraviolet rays, so that when visible and invisible radiations impinge at the same time on the skin, the power of the ultraviolet rays is somewhat lessened. This counteracting or inhibiting action does not, however, seem to be of great magnitude. With the demonstration of a sound scientific basis for heliotherapy as well as actinotherapy with artificially generated radiations, notably as they apply to the treatment or prevention of rickets, new hopes were placed in the efficacy of sunlight. The advocacy of the outdoor life has received a great impetus, and we shall hear much about sunshine and health in the coming months. Unfortunately, there is likely to be some disappointment. Hess has uttered a timely warning based on a study of sunshine in different parts of the world. A comparison of the yearly amount of sunshine in cities in the temperate zone demonstrates that there is no close parallelism between the incidence of rickets and annual sunshine. It shows, furthermore, that the occurrence of rickets does not depend on an equable distribution of sunshine throughout the year. The determining factor, Hess points out, is the quality, not the quantity, of the sun's rays—the amount and intensity of those short ultraviolet radiations which alone are of value in preventing rickets. The results of heliotherapy during the winter months have been disappointing, owing to the fact that the "antirachitic region of the solar spectrum" is greatly limited at this season and that the infants cannot be exposed directly to the rays on account of the severity of the climate. It would seem that the amount of the effective solar radiations is so small in the winter that even if we substitute quartz panes for ordinary window glass, it will be insufficient to afford protection and eradicate rickets. It is in view of this unpromising report that physicians should be prepared, where advisable, to counsel supplementing Nature's niggardly sunshine with the results of man's discoveries. It should no longer be difficult to protect children from rickets; and as antirachitic action consists in the induction of calcium assimilation and its conservation, this is a matter that concerns not only the young but also the adult, particularly when large physiologic demands are made on the latter in pregnancy and lactation.—*J.A.M.A.*, May 30, 1925.

Method of Mitigating Caries: The silver lining to this pathological enigma of dental caries is that, if we are still ignorant of the etiology of the disease, we do know how it can be greatly mitigated. Histologists seem to have overlooked the fact mentioned by Sir John Tomes and Professor W. D. Miller that teeth with contiguous decay in the early stage of the lesion can and do recuperate, or at least the decay is arrested if the stagnation of food débris is prevented. The decay on the mesial side of a tooth and the distal side of another, from between which a tooth decayed on both contiguous sides has been removed, if not so deeply decayed as to be retentive of food débris, becomes gradually brown and then black, and was formerly thought to be a form of caries termed caries nigra, or black decay. The healing shows that the teeth are not inherently deteriorated, so far as the enamel is concerned; that the decay was caused by the stagnation of food; that when by a radical alteration that was remedied, the decay was arrested ad modum naturae. That the decay is automatically arrested points to a system of preventive dentistry by which conscientious dentists, guided by teachers, experience and judgment, could abolish from 75 to 85 per cent of "the curse of the white race."—H. H. Norman, in *Oral Topics,* June, 1925.

Announcements

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Academy of Periodontology, Louisville, Kentucky, September 17-19, 1925.

American Dental Assistants' Association, September 21-25, 1925, Louisville, Kentucky.

American Dental Hygienists' Association, September 21-25, 1925, Louisville, Kentucky.

American Dental Association, September 21-25, 1925, Louisville, Kentucky.

American Medical Association, 1926, Dallas, Texas.

American Society of Oral Surgeons and Exodontists, September 18-19, 1925, Louisville, Kentucky.

International Orthodontic Congress, New York City, August 16-22, 1926.

National Association of Dental Examiners, Louisville, Kentucky, September 21-22, 1925.

Pacific Coast Dental Conference, June, 1926, Portland, Oregon.

Seventh International Dental Congress, August 23-28, 1926, Philadelphia, Pennsylvania.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

National Capital at Washington, D. C., first Tuesday of every month.

September (1925)

Kentucky, at Louisville (18-19).

October (1925)

Florida, at Orlando.
Maryland, at Salisbury (12-13).
New England, at Boston, Mass. (15-17).
Susquehanna, at Wilkes-Barre, Pa., (19-21).

December (1925)

Nevada, at Reno (5).
New York, First District (2-4).
Ohio, at Columbus (1-3).

February (1926)

Minnesota, at St. Paul (10-12).

April (1926)

New Jersey (14-17).

May (1926)

Maryland, at Baltimore (3-5).
New York, at New York City (19-22).

Chicago Dental Society, at Chicago, January 27-29, 1926.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, November 9, 1925. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Massachusetts, at Boston, October 7-10, 1925. Secretary, Joseph N. Carriere.

Michigan, at Ann Arbor, November 16-21, 1925. Secretary, J. W. Lyons, 617-21 Dwight Bldg., Jackson, Michigan.

Ohio, at Columbus, October 26. Secretary, Ray R. Smith, 327 E. State St., Columbus, Ohio.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

The Dental Society of the State of New York will hold the fifty-eighth annual meeting at the Hotel Astor, New York City, May 19-22, 1926. All literary exercises,

clinics and exhibits will be staged at the Hotel Astor.

The Society extends a cordial welcome to all ethical dentists.

Exhibitors are requested to address Dr. H. C. Bennett, Chairman of the Exhibit Committee, 576 Fifth Avenue, New York City, for information and space.

Educational courses will be conducted, Monday, Tuesday and Wednesday, May 17, 18 and 19. Address Dr. Edward Kennedy, Chairman of the Educational Courses, 347 Fifth Avenue, New York City, for information and enrollment.

Make reservations early at the Hotel Astor.

A. P. BURKHART, *Secretary*,
57 East Genesee St.,
Auburn, N. Y.

CHICAGO DENTAL SOCIETY ANNUAL CLINIC AND MEETING

The midwinter clinic and meeting of the Chicago Dental Society will be held at the Drake Hotel, January 27-29, 1926.

All members of the American Dental Association are cordially invited and are most welcome. Information may be secured from any of the following chairmen: Otto U. King, 58 E. Washington St., Program Committee; O. J. Olafsson, 1307 N. California Ave., Clinic Committee; James W. Ford, 25 E. Washington St., Exhibit Committee.

Hotel reservations should be made direct with the particular hostelry you prefer.

For general information address

HUGO G. FISHER, *Secretary*,
25 E. Washington St., Chicago, Ill.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana State Board of Dental Examiners will hold its next examination at the State House, Indianapolis, commencing Nov. 9, 1925. It is of utmost importance that applicants confer with this office for information relative to examination early, as applications properly signed, photographs, and all other credentials must be in the hands of the secretary-treasurer at least five days before examination, without fail.

For information and application, address

J. M. HALE, *Secretary*,
Mt. Vernon, Ind.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The Massachusetts Board of Dental Examiners will hold an examination for registration for both dentists and oral hygienists in the City of Boston, October 7-10. Full information, application blanks, etc., may be secured at the office of the secretary, Room 146, State House, Boston. All applications must be filed at the office of the secretary at least ten days before the date set for the examination.

JOSEPH N. CARRIERE, *Secretary*.

MICHIGAN STATE BOARD OF DENTISTRY

The Michigan State Board of Dentistry will hold its next examination at the Dental College, University of Michigan, Ann Arbor, Nov. 16-21, 1925, beginning at 8 a. m.

For information and application blanks, address

J. W. LYONS, *Secretary*,
617-21 Dwight Bldg.,
Jackson, Mich.

OHIO STATE DENTAL BOARD

The Ohio State Dental Board will hold its fall meeting the last week in October, beginning, Monday, October 26, at Columbus. For further information, address

RAY R. SMITH, *Secretary*,
327 E. State St.,
Columbus, Ohio.

AMERICAN DENTAL ASSISTANTS' ASSOCIATION

You are hereby notified that the first annual session of the American Dental Assistants' Association will be held at Louisville, Ky., Sept. 21 to 25, 1925. General headquarters, Red Room, Hotel Seelbach.

The House of Delegates will convene at 9:30 a. m., Tuesday, September 22, and also on Wednesday, September 23, and at 9:00 a. m., on Thursday, September 24. The general meeting of this first annual session will be held, Tuesday, September 22 at 2 p. m., Red Room, Hotel Seelbach. Wednesday, September 23, from 2 to 4:30 p. m., a group clinic will be given for dental assistants by dental assistants, Red Room, Hotel Seelbach. The annual luncheon of

the association will be given, Thursday, September 24, 12:30 p. m., Hotel Seelbach. General registration of dental assistants will be in the lobby, east entrance, Kosair Temple, September 21, at 8:30 a. m., to September 24. Badges for dental assistants will be issued at general headquarters, Red Room, Hotel Seelbach.

The constituent societies are hereby notified that they are required to file with the general secretary the names and addresses of their delegates and alternates, at least thirty days prior to the first day of this annual session.

All dental assistants are cordially invited to attend all meetings.

JULIETTE A. SOUTHARD, *President*,
174 W. 96th St., New York City.
ANNA H. SYKORA, *General Secretary*,
110 W. 40th St., New York City.

PRELIMINARY PROGRAM OF THE FEDERATION OF AMERICAN WOMEN DENTISTS, LOUISVILLE, KENTUCKY

Monday, September 21

Registration	9 a. m.
Meeting of Executive Board	11 a. m.
Luncheon	1 p. m.
Business meeting	2 p. m.
Banquet	7 p. m.

Program in detail received on registration.

M. EVANGELINE JORDON, *Chairman*,
Publicity Committee.

DENTAL HEALTH TALKS SPONSORED BY THE PUBLIC SERVICE COMMITTEE OF THE CHICAGO DENTAL SOCIETY

The Chicago Dental Society's Public Service Committee is planning a campaign of Dental Health Education, and for that purpose is training a class of twenty-five speakers. In order to secure material for the use of these speakers, $350 will be given in prizes, seven prizes of $50 each, for the best twenty minute speech suitable for presentation to the following types of audiences: grammar school children, high school pupils, parent-teacher audience, Kiwanis or Rotary Club audience, church audience, factory talk, employe audience, or radio talks.

Points to be considered are: simplicity of English, facts and suitability for specific audience.

Any contributor is eligible to write on any or all subjects. Write on one side of paper only. Place manuscript in envelope, with separate note giving name and address of sender. Writers agree that all material may be used by committee. All material should be in by October 1, 1925.

Address all mail to Dr. F. Blaine Rhobotham, Room 1406, Field Annex Building, Chicago.

HERBERT E. PHILLIPS, *Chairman*,
Sub-Committee on the Lay Education of the Public Service Committee of the Chicago Dental Society.

INTERNATIONAL ORTHODONTIC CONGRESS

The first International Orthodontic Congress will be held in New York City, Aug. 16-22, 1926.

WILLIAM C. FISHER, *President-General*,
501 Fifth Ave., New York City.
WALTER H. ELLIS, *Secretary-General*,
397 Delaware Ave., Buffalo, N. Y.

LADIES' AUXILIARY OF THE AMERICAN DENTAL ASSOCIATION

The Ladies' Auxiliary of the American Dental Association will hold its first meeting, Monday, September 21, at the Brown Hotel, where a luncheon will be given, at 1 o'clock, immediately following the meeting.

MRS. HOMER BROWN, *President*,
MRS. CHARLES CHANNING ALLEN, *Secretary*.

NATIONAL ALUMNI CHAPTER XI PSI PHI FRATERNITY MEETING

The annual meeting of the National Alumni Chapter Xi Psi Phi Fraternity will be held at the Watterson Hotel, Monday, September 21, at 9 a. m. A banquet will be given Monday evening at the Watterson Hotel.

J. EMMETT NORTHCUTT, *President*,
St. John & Elmwood Aves.,
Kansas City, Mo.
GEORGE W. HILLIAS, *Sec'y-Treas.*,
Bryant Bldg.,
Kansas City, Mo.

XI PSI PHI FRATERNITY, SUPREME CHAPTER, MEETING

The biennial meeting of the Supreme Chapter Xi Psi Phi will be held at the Watterson Hotel, Louisville, Ky., September 18-19, 1925.

The annual banquet will be held at the Watterson Hotel, Monday evening, September 21, at 6 p. m. All members of the fraternity are cordially invited to attend.

E. D. COOLIDGE, *Supreme President*,
25 E. Washington St., Chicago, Ill.
H. B. PINNEY, *Supreme Sec'y-Treas.*,
108 N. State St., Chicago, Ill.

GOLF TOURNAMENT

The 1925 meeting of the American Dental Golf Association will be held in Louisville, Ky., September 21-25. Arrangements are being made for a great tournament. The annual dinner and Calcutta Pool will be held Sunday night, September 20, in the Seelbach Rathskeller.

Play for the different handicap events and different classes will be held on Monday, Tuesday and Wednesday, September 21-23, the names of those qualifying being posted at the Brown Hotel, Thursday morning. The tournament takes place Friday, September 25, at the Audubon Country Club. Those wishing to qualify for these events must play in foursomes and should register their intention before starting to play. Dr. Louis G. Burgard, chairman of the local committee, will be glad to furnish any information desired. Address him, Starks Building, Louisville, Ky.

Non-Member, "It's great to be a Golfer"—won't you join the ranks? Three dollars attached to your application blank makes you a life member. The secretary, Dr. Thomas P. Hinman, 507 4th National Bank Building, Atlanta, Ga., will furnish the application blank and membership card.

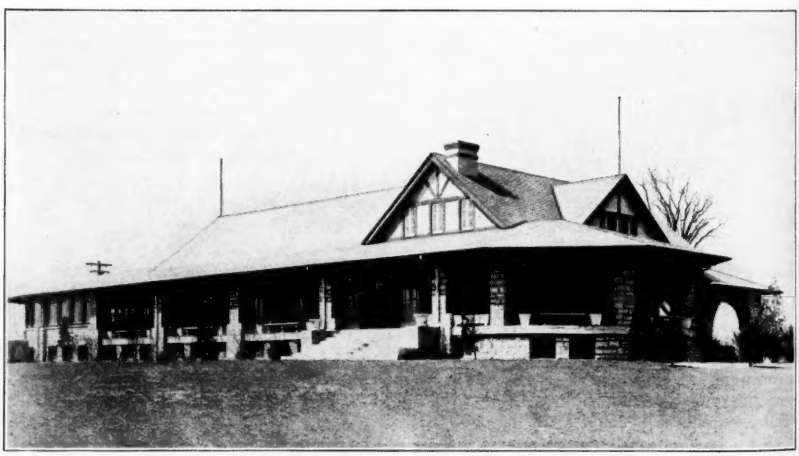
Let's go!

REDUCED RATES TO THE LOUISVILLE MEETING

An Identification Certificate will be sent to each member of the American Dental Association, probably a month before the meeting.

This certificate, when properly filled out and presented to the local ticket agent, will authorize him to sell round trip tickets to members of the Association and dependent members of their families at one and one-half fare. Tickets will be good via the same route in both directions.

Tickets will be on sale in New England, Trunk Line, Central and Southeastern Pas-



Audubon Country Club

senger Association territories, September 16-22, good returning not later than midnight, October 1.

Southwestern Association territory, Arkansas, Kansas, Louisiana and Missouri, sale September 16-22, with return October 1. Oklahoma and Texas sale September 15-21, with return October 2.

Western and Trans-Continental Association territory, Illinois, Iowa, Kansas, Manitoba, Winnipeg, Minnesota, Missouri, Nebraska, Northern Michigan, North Dakota, South Dakota and Wisconsin, sale September 16-22, with return October 1. Colorado, Montana, New Mexico, Utah and Wyoming, sale September 15-21, with return October 2.

Arizona, British Columbia, California, Idaho, Nevada, Oregon and Washington, sale September 13-19, with return October 6. Summer excursion fares on a lower basis than round trip identification certificate plan fares will also be in effect from this territory, with tickets on sale daily from May 22 to September 15, and return limit October 31.

Tickets will be validated at Louisville, at the regular ticket offices of the lines over which the tickets read, into Louisville, on any date to and including the final return limit, and when validated will be good leaving Louisville on any date within the final return limit; but passengers must reach original starting point prior to midnight of final limit.

D. C. BACON, *Chairman*,
Transportation Committee,
31 N. State St., Chicago, Ill.

PATENTS RELATING TO DENTISTRY

1459171. Apparatus for removing abrasive disks from grinding wheels, F. A. and M. D. Willard, Jackson, Mich.

1459951. Dental bridge, H. Eisele, Omaha, Nebr.

1459831. Toothbrush holding device, C. L. Jones, Altus, Okla.

1460204. Collapsible tube holder and content ejector, E. A. Maraffi, Bridgeport, Conn.

1460179. Dentifrice, W. M. Ruthrauff, Philadelphia, Pa.

1527028. Combined toothpick and tooth cleaner, H. S. Daniel, Mexico, Mo.

146531. Hemostatic forceps, John F. Callahan, Brockton, Mass.

1460995. Toothbrush holder, Walter W. Welpley, Detroit, Mich.

1460691. Artificial tooth, James L. Williams, New York, N. Y.

1461340. Radioactive spray material, Ralph R. Adams, Yonkers, N. Y.

1461209. Detachable holder for dental impression trays, Josiah S. Bridges, Chicago, Ill.

1461305. Artificial teeth, John Brookes and A. E. Tolley, Halesowen, Eng.

1461609. Collapsible tube closure, Gerald E. Force, New York, N. Y.

1462062. Toothpick and making same, George M. Browning, New York, N. Y.

1462232. Valve collapsible tube, Herbert L. Frizell, Dorchester, Mass.

1462334. Sterilizing container, Gilbert M. Gross, Eldorado Springs, Mo.

1461922. Combined toothbrush and dentifrice container, Wm. E. Little, Chicago, Ill.

1461804. Combined toothbrush and water-glass holder, Robert D. Mayo, Cleveland, Ohio.

1461765. Dental tray, Henry E. Weber, Canton, Ohio.

1462954. Alloy and mercury dispenser, Ira A. Burnett, Chicago, Ill.

1462632. Method and apparatus for rectifying polyphase currents, George B. Coleman, San Francisco, Calif.

1462633. Producing direct current from an alternating current and means therefor, George B. Coleman, San Francisco, Calif.

1462634. Means and method of conversion between alternating and direct currents, George B. Coleman, San Francisco, Calif.

1462888. Dental suction plate, Jacob Petry, Pittsburgh, Pa.

1462656. Dental appliance unit, Oscar H. and A. F. Pieper, Rochester, N. Y.

1463548. Metallic denture backing, Robert M. Craig, Wilkinsburg, Pa.

1463578. Measuring device for collapsible tubes, Frank L. Dyer, Montclair, N. J.

1463390. Breath mask, Antonio Fernandez, Kansas City, Mo.

1464474. Dental articulator or relator, Joseph Homer, Boston, Mass.

1464320. Closure for collapsible tubes and other containers, Joseph Kaufman, New York, N. Y.

Copies of above patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N.W., Washington, D. C.

Encourage These Men

By Ernest V. Madison

THE publisher of this journal and the manufacturers who advertise in it are striving to do a certain work: the *publisher*, to issue an interesting, valuable paper and to place before the manufacturer a very direct medium for reaching possible buyers of his product; the *manufacturer*, to increase the number of persons benefited by these products.

Both efforts are commendable, are for our *great good*, and should be rewarded with cooperation and expressed appreciation.

Show these men that you appreciate the work they are doing!

Tell the publisher of this journal, by letter or word, that you like it; suggest ways in which you believe it might be made more valuable to readers.

Let the manufacturer know that you have observed his efforts to keep you informed about his products. Let him know this by writing him that you have read his advertisements in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

ANNO 1800